

CONJUNCTIONS AND GRAMMATICAL AGREEMENT

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ABSTRACT

This dissertation investigates the factors involved in producing agreement, using evidence from conjoined subjects in English and Lebanese Arabic. Specifically, the goal was to test psycholinguistic and syntactic theories of agreement by examining the relative contributions of lexical number, notional number, adjacency, and linear word order in agreement with conjoined subjects, and contrasting English agreement patterns with Lebanese Arabic, which allows closest conjunct agreement with postverbal subjects.

Corpus data and sentence production experiments were used to test hypotheses about the mechanisms involved in producing agreement. A search of American English sentences from the World Wide Web revealed that speakers often produce singular verbs with conjoined subjects (28% singular verbs overall), but less often when the conjunctions involved animate or plural nouns. To investigate these patterns experimentally, English-speaking participants heard, repeated, and completed subject noun phrases as full sentences, thus producing a verb. The experiment produced results similar to the corpus search, with conjunctions involving singular, abstract nouns eliciting more singular verbs than plural verbs.

In a second study involving both Lebanese Arabic and English speakers, a picture description task manipulated the position of the subject relative to the verb and revealed that singular verbs were much more frequent with postverbal (versus preverbal) subjects and that lexically plural nouns were stronger enforcers of plural agreement than conjoined singular subjects in both Lebanese Arabic and English. Adjacency also played a role, as plural nouns in furthest conjunct position did not enforce plural agreement in the same way as plural nouns that were linearly adjacent to the verb. These results indicate that notional information, lexical plurality, adjacency, and linear (surface) word order play significant roles in the computation and

production of agreement. The results also shed light on the nature of closest conjunct agreement and on the number of stages involved in producing grammatical agreement.

To my grandmother, Esther, whose encouraging words carried me through the hard times
and to my husband, Anthony, who could always make me smile.

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TABLE OF CONTENTS

LIST OF TABLES	xi
LIST OF FIGURES	xiv
CHAPTER 1: INTRODUCTION	1
Conjoined Subjects	1
Single Conjunct Agreement	2
Effects of Word Order	3
Scope of this Project	3
CHAPTER 2: SYNTACTIC THEORIES OF AGREEMENT	6
Overview of Theories of Agreement	6
Conjoined Subjects	9
Single Conjunct Agreement	16
Word Order Effects	18
Syntactic Accounts of Single Conjunct Agreement	20
CHAPTER 3: PSYCHOLINGUISTIC THEORIES OF AGREEMENT	61
Speech Errors in Agreement	62
Influence of Semantics on Agreement	66
Syntactic Factors in Agreement	72
Role of Morphophonology in Agreement	77
Psycholinguistic Models of Agreement	80
One or Two Stages of Agreement	89
Summary	90
CHAPTER 4: COUNTING CONJUNCTIONS	92
Method	93
Results	96
Discussion	102
CHAPTER 5: ONE AND ONE MAKES SINGULAR AGREEMENT	105
Experiment 1: Constrained Sentence Completion Task	114
Experiment 2: Unconstrained Sentence Completion Task	123
General Discussion	127
CHAPTER 6: WORD ORDER AND CLOSEST CONJUNCT AGREEMENT	130
Experiment 3: Closest Conjunct Agreement in English	137
Experiment 4: Furthest Conjunct Agreement in English	152
Experiment 5: Closest Conjunct Agreement in Lebanese Arabic and English	161
General Discussion	184

CHAPTER 7: SYNTACTIC AND PSYCHOLINGUISTIC IMPLICATIONS.....	189
Syntactic Implications for Analyses of Closest Conjunct Agreement.....	190
Spec-Head or Linear Precedence?	197
One or Two Stages of Agreement?.....	201
Conclusions.....	204
Future Directions	205
REFERENCES	206
APPENDIX A: MATERIALS FOR SENTENCE COMPLETION TASK	214
APPENDIX B: MATERIALS FOR PICTURE DESCRIPTION TASK	216
CURRICULUM VITAE.....	217

LIST OF TABLES

Table	Page
2.1 Complementizer Agreement in Tegelen Dutch.....	33
2.2 Complementizer Agreement in Tiel Dutch.....	33
2.3 Complementizer Agreement in Bavarian.....	34
2.4 Agreement Rankings with Postverbal (a) Indexed and (b) Unindexed Conjoined NPs in Czech (from Badecker, 2007).....	58
4.1 Summary of Coding for Corpus Study.....	95
4.2 Number Marking on Conjoined Nouns x Verb Agreement.....	97
4.3 Noun Type x Verb Agreement.....	100
4.4 Noun Type x Verb Agreement, when Both Conjuncts were Singular.....	101
5.1 Types of Nouns in Sentence Completion Task.....	116
5.2 Normative Ratings for the Items used in Sentence Elicitation Task.....	119
5.3 Proportion Singular Verbs by Category, Exp. 1.....	121
5.4 Proportion Singular Verbs by Category, Exp. 2.....	126
6.1 Example Manipulation of Noun Number across Lists.....	143
6.2 Scoring Criteria for Picture Elicitation Task.....	144
6.3 Distribution of Responses over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 3.....	146
6.4 Distribution of Responses over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 3.....	147
6.5 Analysis of Variance Results, Noun Type x Sentence Type, Exp. 3.....	149
6.6 Analysis of Variance Results, Sentence Type x Noun Number x Noun Type, Exp. 3...	151

6.7	Distribution of Responses over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 4	155
6.8	Distribution of Responses over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 4.....	155
6.9	Analysis of Variance Results, Noun Type x Sentence Type, Exp. 4.....	156
6.10	Analysis of Variance Results, Sentence Type x Noun Number x Noun Type, Exp. 4...	158
6.11	Distribution of Responses over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 5 – English Speakers.....	167
6.12	Distribution of Responses over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 5 – English Speakers	168
6.13	Analysis of Variance Results, Noun Type x Sentence Type, Exp. 5 – English Speakers	169
6.14	Analysis of Variance Results, Sentence Type x Noun Number x Noun Type, Exp. 5 – English Speakers.....	171
6.15	Distribution of Responses for Verb Number over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 5 – Lebanese Speakers	173
6.16	Distribution of Responses for Verb Number over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 5 – Lebanese Speakers	174
6.17	Analysis of Variance Results for Verb Number, Noun Type x Sentence Type, Exp. 5 – Lebanese Speakers	175
6.18	Analysis of Variance Results for Verb Number, Sentence Type x Noun Number x Noun Type, Exp. 5 – Lebanese Speakers	177

6.19	Distribution of Gender Agreement on Verbs by Gender of Subject Nouns for Singular-Singular Postverbal Subjects, Exp. 5 – Lebanese Speakers.....	179
6.20	Distribution of Responses for Adjective Number over Scoring Categories for Noun Number, Noun Type, and Word Order Manipulation, Exp. 5 – Lebanese Speakers.....	180
6.21	Analysis of Variance Results for Agreement on Adjectives, Noun Type x Sentence Type, Exp. 5 – Lebanese Speakers	181

LIST OF FIGURES

Figure	Page
5.1	Proportion Singular Agreement in Experiments 1 & 2 and with the Singular-Singular Conjunctions from the Corpus 127
6.1	Types of Conjunctions used in Noun Type Contrast 140
6.2	Example of Plural-Singular Item for the Noun Number Contrast..... 140
6.3	Proportion Singular Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 3 148
6.4	Proportion Singular Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 3..... 150
6.5	Proportion Singular Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 4 157
6.6	Proportion Singular Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 4..... 159
6.7	Proportion Singular Agreement by Word Order and Number Marking on Conjunctions, Experiments 3 & 4..... 161
6.8	Proportion Singular Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 5 – English Speakers..... 170
6.9	Proportion Singular Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 5 – English Speakers 172
6.10	Proportion Singular Verb Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 5 – Lebanese Speakers 176

6.11	Proportion Singular Verb Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 5 – Lebanese Speakers.....	178
6.12	Proportion Singular Adjective Agreement for Sentence Type and Noun Type, Experiment 5 – Lebanese Speakers	182

CHAPTER 1: INTRODUCTION

“I have to see what my HDL and LDL is.” – overheard at Lincoln Square Mall in Urbana

Agreement is a basic property of language. In the most basic sense, agreement occurs when two elements in the appropriate configuration exhibit morphology consistent with their co-occurrence. Perhaps the most transparent case of this linguistic mechanism is number agreement between a subject and a verb: A singular noun in the subject position regularly co-occurs with a singular verb (e.g., “the dog runs”), and a plural subject noun regularly co-occurs with a plural verb (e.g., “the dogs run”). If the language has number marking on other elements, such as determiners or adjectives, these should also exhibit morphology that is consistent with their relationship to the subject head noun, and this co-occurrence relationship holds for gender and person agreement as well.

What’s particularly remarkable is how quickly and effortlessly the computation of agreement proceeds. In English, agreement is computed approximately once every 16 words (or every 5 seconds in running speech), and it rarely requires any conscious thought (Eberhard, Cutting, & Bock, 2005). Speakers effortlessly make decisions about agreement, that clothing *is*, but clothes *are*, corresponding to the number marking on the subject noun (Bock, Eberhard, Cutting, Meyer, & Schriefers, 2001; Humphreys & Bock, 2005).

Conjoined Subjects

With conjoined subjects (e.g., “the circle and square”), however, neatly mapping lexical number onto verb number is impossible. Two conjoined singular nouns most often take plural verb agreement (Gleitman, 1965), which means that the plural verb agreement must come from somewhere other than the lexical number on either of the individual nouns. Because the plural marking cannot originate solely from the number marking of the nouns themselves, several other

solutions have been proposed. One solution is that the conjoined noun phrases are syntactically singular, and if they gain a plural marking, it is because of conceptual plurality (Johannessen, 1996). Another solution is that there are null plural pronominals, along with the conjoined noun phrases, and that the conjunctions function like an appositive – restating the subject (Citko, 2005). Some analyses do mark the conjunction phrase itself as plural, gained either from the “and” itself or from the structure of the conjunction phrase (Soltan, 2007).

Conjoined subjects (i.e., subjects of the form “NP *and* NP”) are also unique because they show more flexibility than ordinary lexical plurals in their ability to occur with both singular and plural verbs, depending on the referent(s). If the conjoined nouns have a singular referent, the verb can take singular agreement. However, if the conjoined nouns have distinct referents, plural agreement is preferred. For example, with the conjoined noun phrase, “the most expensive item and the last one to be sold”, singular agreement is preferred if the most expensive item *was* the last item sold, but plural agreement is preferred if those two items are distinct. Similarly, a speaker might decide that bacon and eggs *is* fast and filling, but bacon and eggs *are* high in cholesterol. In the first case, bacon and eggs constitutes a meal, while in the second case, their dietary properties are highlighted, reflecting a distributive interpretation.

Single Conjunct Agreement

Another type of flexibility observed with conjoined subjects is the option of single conjunct agreement, in which verbs and predicate adjectives agree with only one of the two conjuncts. The most famous case of single conjunct agreement is in Modern Standard Arabic, where agreement with the closest conjunct is obligatory when the verb precedes the subject (Aoun, Benmamoun, & Sportiche, 1994). This is alternatively termed “Partial Agreement”, “Closest Conjunct Agreement”, or “First Conjunct Agreement”, because this type of agreement

occurs most often when the verb precedes the subject, where the first conjunct *is* the closest conjunct (Corbett, 2006). To illustrate, if English had First Conjunct Agreement with postverbal subjects, as some have argued for “there” constructions (Munn, 1999), you would see a singular verb, followed by a conjoined subject (e.g., “There *is* a dog and a cat in the room”), if the first conjunct is singular. In a language with gender agreement, the verb would agree with the first (closest) conjunct in gender and number, as if the first conjunct were the full subject of the verb.

This phenomenon is most common with postverbal conjoined subjects, where agreement is with the first (closest) conjunct. It is, however, also documented with the closest (second) conjunct and with the furthest (first) conjunct for preverbal subjects in languages such as Latin and Slovene (Badecker, 2007). The pattern that has never been observed, however, is furthest (second) conjunct agreement with postverbal subjects (Corbett, 2006).

Effects of Word Order

Single Conjunct Agreement is one area in which word order frequently affects agreement patterns, but asymmetries depending on word order are not limited to the phenomenon of single conjunct agreement. In Modern Standard Arabic, verbs that precede lexical subjects are *always* singular, regardless of the number marking on the nouns (Fassi Fehri, 1993). Therefore, if there is First Conjunct Agreement, it is only observed through gender agreement or through agreement with pronominals (which agree in number, regardless of word order). In some languages, word order consistently affects agreement patterns, while in other languages, the effect of word order on agreement appears sporadically and is speaker- or situation-dependent (Corbett, 2006).

Scope of this Project

This project will focus primarily on conjoined subjects and their agreement relationships with verbs and predicate adjectives. For the purpose of this study, conjoined subjects are defined

as two noun phrases conjoined by the connector “and” and by its equivalents in other languages. While this study focuses solely on conjoined subjects with just two conjuncts, it is likely that the findings will extend to lists (e.g., “NP, NP, and NP”) and that some of the discussion will be relevant to disjunctions (e.g., “NP or NP”) as well, although these particular constructions are troublesome because of the difficulty in isolating the logical subject (whether the exclusive or inclusive “or” is used).

The goal of this study is to determine how conjoined subjects function as agreement controllers, with the purpose of understanding what role notional number, lexical plurality, word order, and linear proximity play in the computation of agreement. The results will be discussed in terms of the major syntactic and psycholinguistic models of agreement, which will be outlined in Chapters 2 and 3.

To accomplish this, the study employs several methodologies of experimental language research. Chapter 4 details a corpus study in which conjoined subjects in American English were extracted from the World Wide Web and were analyzed for their lexical, syntactic, and semantic properties. The goal of the corpus study was to understand the general behavior of conjoined subjects in American English, examining various factors that might affect their agreement properties. Chapter 5 reports on a set of sentence completion experiments, using both highly controlled elicitations and free completion tasks, which tests the findings of the corpus study and further explores the semantic issues in forming agreement with conjoined subjects. Chapter 6 explores the behavior of conjoined subjects more fully by examining the impact of word order and noun number on agreement, comparing word order effects in English to the patterns observed in First Conjunct Agreement in a series of tasks with American English and Lebanese

speakers. Chapter 7 discusses the results from syntactic and psycholinguistic perspectives, and concludes with implications for how agreement works.

While primarily addressing agreement issues in English and Lebanese Arabic, it is the author's intent to always strive for cross-linguistic validity. This work will therefore include discussions of Russian, Finnish, Portuguese, Greek, Slovene, Welsh, and other languages when data from these languages provide helpful insight into the nature of the agreement system. These comparisons will aim to tease apart issues of morphology, head-structure, word order, and other factors involved in agreement to gain a deeper understanding of how the human language mechanism works.

CHAPTER 2: SYNTACTIC THEORIES OF AGREEMENT

What factors are involved in agreement and how agreement is computed has been the subject of extensive debate, both in linguistics and in psychology. Linguists struggle over resolution rules, agreement asymmetries, and apparent mismatches when features seem to contradict each other. Psychologists explore the mental machinery involved in producing agreement by looking for hierarchical, linear, notional, and morphological factors that can influence what kind of agreement morphology is produced. This chapter will deal with syntactic accounts of agreement, with a specific focus on agreement with conjoined subjects. The discussion will begin with an overview of the types of theories of agreement, then continue issues of agreement with conjoined subjects and word order, and finally move to accounts of agreement with conjoined subjects and single conjunct agreement from a wide range of syntactic frameworks.

Overview of Theories of Agreement

Many mainstream linguistic models attribute the reflex of verb agreement to the complete control of the subject. In these models, the number marking on the subject dictates gender and person marking as well as whether the verb should be singular or plural (or dual), as in traditional Government and Binding Theory (Chomsky, 1981) or in Generalized Phrase Structure Grammar (Gadzar, Klein, Pullum, & Sag, 1985). These are asymmetrical accounts of agreement, in which the subject head noun specifies the number of the verb and other modifiers. There are other syntactically-motivated theories in which verb agreement is more symmetrical in nature. These theories maintain that the subject and the verb each obtain agreement specifications independently, and they check with each other to verify that they agree in the appropriate

features, as in systems like Head-Driven Phrase Structure Grammar (Pollard & Sag, 1994) or in Minimalism (Chomsky, 1995).

It has also been long understood that semantic and even pragmatic components are relevant for the computation of agreement (Chung, 1998; Green, 1984; Morgan, 1984). Morgan (1972, 1984) explored the complexity of number agreement by outlining situations in which semantics seems to dictate agreement (1a-c; from Morgan 1984:72) as well as sentences in which agreement with the lexical number of the subject noun phrase is strictly required (2a-d; from Morgan 1984:74).

1. a) His aged servant and the subsequent editor of his papers was/were with him at his death bed.
- b) Harry and only Harry is/*are going to be allowed to read this.
- c) Pickles and ice cream is/are delicious.

In sentences (1a-c), it is the real-world referent that determines the number of the verb rather than the grammatical number of the nouns themselves. Singular verbs are chosen if the referent is singular, but in cases of multiple referents, the verb number reflects that plural meaning. Sentences such as (c) demonstrate the ability of a speaker to take perspective, to “zoom in” and focus on the components, or to “zoom out” and focus on the composite. In food items, this type of flexibility is common, as various types of food are frequently combined to produce dishes such as potatoes and onions, rice and beans, or fish and chips.

Sentences (2a-d) demonstrate a situation in which the converse is true. While (2a-b) describe the same situation, as do (2c-d), they require different number markings on their verbs. Truth-conditionally, these sentences are equivalent. However, the verb number that is required

for the grammaticality of these sentences depends crucially on the subject head noun and is unaffected by the number meaning of the real-world referent.

2. a) More than one student has/*have passed the exam.
- b) More students than one *has/have passed the exam.
- c) No students *has/have failed the exam.
- d) No student has/*have failed the exam.

One important generalization, however, should not be missed in discussing the differences between the sentences in (1) and the sentences in (2). In (1), the subjects are conjoined noun phrases, one type of non-canonical subjects. In (2), the subject head nouns are animate, count lexical nouns marked as singular (“student”) or plural (“students”). The majority of flexibility in agreement occurs when subjects are non-canonical to some degree. Either they exhibit a mismatch in notional/grammatical agreement features, or they are abstract, inanimate, or somehow less worthy of topic-hood (Comrie, 2003).

Theories of agreement struggle to reconcile these agreement facts. Chung (1998) categorizes classes of theories of agreement, based on the factors they include. There are some that invoke morphological operations to manipulate features and achieve agreement (Anderson, 1992; Halle & Marantz, 1993). Semantically-based theories, on the other hand, take agreement to be due to the properties of the referents or to at least one of the agreeing elements (Dowty & Jacobson, 1989; Lapointe, 1980). Yet other approaches, which Chung terms “modular”, draw from morphosyntactic, semantic, and pragmatic information (Farkas & Zec, 1995; Pollard & Sag, 1994). The necessary components of an agreement system will be examined in turn, but before delving into agreement theories, it is worthwhile to discuss the type of sentences that will be used in this inquiry – namely those involving conjoined subjects.

Conjoined Subjects

Conjoined subjects are interesting because they provide instances in which agreement cannot depend on the percolation of the grammatical features on the subject head noun to determine properties of number agreement. Instead, conjoined noun phrases contain two nominative nouns, neither of which is solely in control of agreement, and if agreement operates with the conjunction as a whole, it must be the product of a resolution process that arbitrates between the agreement properties of the individual nouns (Badecker, 2007). In general, most conjoined subjects take plural agreement, as would be expected if conjoined nouns were in an additive relationship, if *one* and *one* equal *two* (Gleitman, 1965). While conjoined noun phrases (e.g., “*John and Mary*”) and plural noun phrases (e.g., “*students*”) might share the same referents, they differ in one major aspect: In the conjoined noun phrase, there is no overt plural marker, and each of the individual nouns is singular. With plural noun phrases, on the other hand, the plural marker is specified morphologically on the noun itself.

The plural properties of conjoined noun phrases must therefore be derived from a different source than those of lexically plural nouns. For conjoined noun phrases such as *John and Mary*, each of the nouns has its own grammatical number, the *and* specifies that more than one element is involved, and an additive interpretation would indicate that the resulting conjoined noun phrase is plural, so an agreeing predicate “should” be marked as plural. However, singular agreement with conjoined subjects is also possible when the subject has a singular referent. Certain conjunctions, such as *rice and beans* or *ham and eggs*, are generally interpreted as units, and they agree with singular verbs. One explanation is that these are not true conjunctions – they’re just names of dishes that are served together, to be compared to proper

names, but the tendency to produce singular agreement with conjoined subjects is productive and does not apply only to fixed expressions such as *ham and eggs*.

Singular agreement with conjoined subjects frequently occurs in spontaneous speech. The following are just a few examples of conjoined subjects that preceded singular verbs from radio announcer speech: *the US and the world*, *perfume and deodorant*, *death and destruction*, *your item and story*, *prayer and faith*, and *light rain and drizzle*. Examples of singular agreement with conjoined subjects are also found in written texts. Sentences (3a-b) were taken from prominent academic sources:

- 3 a) "The Projection Principle and a generalized view of movement entails that there will be traces at LF." p. 71, *Simpler Syntax*. Culicover and Jackendoff, 2005.
- b) "However, the efficiency and speed with which we are capable of reading for meaning has sometimes been taken to imply that a single mechanism (i.e., a single process) is sufficient to account for processing at the single word level." *Psych Review*. Borowsky et al., 2006

Popular print media also contain instances of singular agreement, sometimes to the dismay of the grammar police. In both of these examples, which were cited by William Safire in the New York Times Magazine, the conjoined nouns are describing a single action.

4. a) "I think drinking and driving is a really bad thing."
- b) "The manufacture and distribution of cash is by far the Federal Government's biggest profit-making operation."

In (4a), it is not drinking itself that is designated as a crime, and neither is driving a crime by itself. Instead, it is the combination of performing both actions at the same time that is judged as a negative behavior. Similarly, the Federal Government makes its profit through an operation

that necessarily involves both manufacturing and distributing cash, and since this process is conceptually singular, singular agreement is the result.

Typological Issues with Conjoined Subjects

Languages differ in terms of the options that are allowed in the structural and interpretive properties of conjoined subjects, and I will highlight some of the options briefly. One major difference is in the scope of modifiers of conjoined noun phrases. In some languages, modifiers agree only with the local noun, while in other languages, modifiers can take scope over the whole conjunction. In English, determiners (e.g., “a, the”) and demonstratives (e.g., “this, these”) remain local to the nouns themselves, so singular nouns are always preceded by singular modifiers (5a), and plural modifiers are prohibited (5b), which means that speakers are not treating the conjoined noun phrase in the same way as they would treat a plural noun (5c).

5. a) This man and woman
- b) *These man and woman
- c) These men

What is interesting is that, although these determiners and demonstratives agree with the local nouns, they can satisfy syntactic requirements of the second conjunct. For example, singular count nouns in English are required to have determiners. However, if the second conjunct is a singular count noun, the determiner/demonstrative on the first conjunct satisfies the second conjunct’s requirement (6a). Of course, the second conjunct can have its own determiner or demonstrative (6b), but it is not required, and when it appears, it serves to emphasize the second conjunct.

6. a) This man and woman
- b) This man and this woman

Similarly, adjectives that precede the first conjunct can take scope over both conjuncts in English (e.g., “the old books and magazines”), depending on the semantic compatibility of the adjective with the second conjunct.

Finnish has two options for adjective agreement with conjoined noun phrases, depending on the semantic relatedness of the conjoined nouns. The first type of modification occurs when conjoined singular nouns are modified by a plural adjective. (Data taken from Dalrymple & Nikolaeva (2006).)

7. Iloiset mies ja poika lähtivät yhdessä käsi kädessä (Finnish)

happy.PL man and boy left.3PL together hand hand.INES¹

“The happy [man and boy] left together hand in hand.”

There are other instances, however, in which plural adjectives cannot be used with conjoined singular nouns, which Dalrymple and Nikolaeva attribute to their being semantically unrelated and only “accidentally” coordinated.

8. *Han osti uudet talon ja auton.

he bought.3SG new.ACC.PL house.ACC and car.ACC

“He bought a new [house and car].”

The reason that some conjunctions can be modified by a plural adjectives while others cannot, according to their analysis, is that semantically related nouns (e.g., “man” and “boy), when conjoined, are a type of “natural coordination”, and they behave like plural nouns. The other type of conjunctions, composed of nouns like “house” and “car”, they argue, are joined together on an ad-hoc basis, forming “accidental” coordination, which does not allow plural adjectives. Instead, there are two options for modifiers: While some speakers allow singular agreement on the adjective (i.e., “new_{SG} house and car”), others require that each noun be modified individually

¹ INES stands for inessive, a case that expresses a location within the referent of the noun it marks.

(i.e., “new house and new car”). The difference, according to Dalrymple & Nikolaeva, between the speakers who allow singular agreement on only one adjective (i.e., “new house and car”) and those who require an adjective on each noun is whether or not they allow closest conjunct agreement. For speakers that allow closest conjunct agreement, a single adjective can be interpreted as modifying both, but for those speakers who do not have the option of closest conjunct agreement in their grammar, agreeing adjectives must appear locally on each conjunct².

Distributive and Collective Interpretations

While conjoined noun phrases are embedded inside the same phrase, their relationship to each other depends greatly on the predicate and on the speaker’s intention. The types of conjoined noun phrases are wide and varied, and the relationships between the nouns are varied as well (Dik, 1968). Dik distinguishes between conjunctions, depending on whether the conjuncts are interpreted as forming a unit (i.e., ‘M₁ and M₂ taken together’ (9a)) or whether they individually satisfy the demands of the predicate (i.e., ‘M₁ and M₂ combined, but each separately relevant’ (9b)). These types of interpretation are revealed through quantifiers such as *both*. (Examples taken from Dik, 1968: 272-273.)

9. a) Sugar and water make syrup.

b) *Both sugar and water make syrup.

(unless sugar and water can each independently make syrup)

c) John and Bill are painters.

d) Both John and Bill are painters.

² The data for the Finnish study (Dalrymple & Nikolaeva, 2006) were obtained through translation tasks, so the translators may have been adopting strategies, creating a stronger divide between speakers in terms of the options allowed in their grammar. It would be helpful to supplement these sources with data from spontaneous speech or language production tasks to understand why some speakers appear to be allowing closest conjunct agreement, while others do not.

Lasersohn makes a similar distinction between the distributive and collective interpretations of conjoined noun phrases, crucially depending on the predicate to dictate whether the clausal conjunction interpretation is possible (whether each actor is acting separately) (Lasersohn, 1995).

10. a) John and Mary are a happy couple. /

*John is a happy couple and Mary is a happy couple.

b) John and Mary are asleep. /

John is asleep and Mary is asleep.

In English, plural agreement tends to occur with both distributive and collective interpretations, as in 11(a-b), at least with animate subjects

11. a) John and Mary are reading.

b) *John and Mary is reading. / John [is reading] and Mary is reading.

When singular agreement is observed in English, it occurs when the subject nouns either share a referent (12) (Bock, Eberhard, & Cutting, 2004) or when they coalesce into something that is notionally singular, describing a single object, entity, or event. Sentence (9a – repeated for convenience) would also be acceptable with a singular verb for many speakers of American English, since the ingredients sugar and water combine into a mixture that makes syrup.

12. My brother and best friend was with me. (my brother = my best friend)

9. a) Sugar and water make/makes syrup.

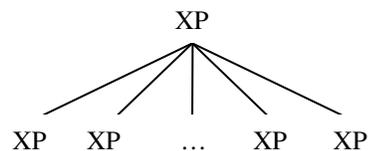
The Structure of Conjoined Subjects

Understanding how to analyze the structure of conjoined subjects is far from straightforward, especially because of the range of their semantic interpretations and variability of agreement patterns across languages. The first issue concerns what exactly is conjoined: Is it determiner phrases or conjoined clauses with gapping? If determiner phrases are conjoined, is

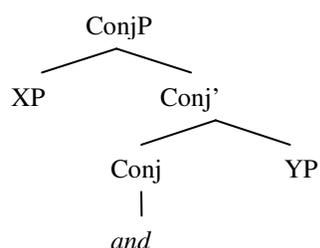
this symmetrical or asymmetrical conjunction? What is the head of the conjoined noun phrase? And how does the conjunction obtain its plural specification?

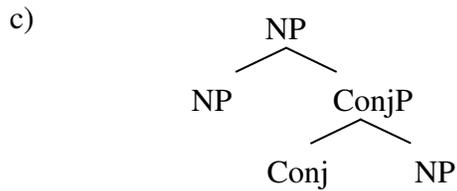
The traditional analysis of conjoined noun phrases has been a symmetrical one (Fidelholtz, 1964; Lakoff & Peters, 1966; Peters, 1966). The number specification has been analyzed as either coming from the *and* itself or from the meaning of the conjunction. This flat structure was considered to be exocentric, either multi-headed or non-headed, and its form was generally represented with a pattern similar to (13a). Another proposal, which has been widely utilized within the Principles and Parameters theory and within Minimalism, has described the conjunction phrase as an asymmetric, singly-headed structure, similar to the other asymmetric phrases within the grammar and in the X' schema (Johannessen, 1996, 1998; Kayne, 1994; Radford, 1993). Within this analysis, which lists the head of the phrase as the conjunction, the conjuncts themselves occupy the specifier and complement positions, as represented in (13b) (Carston & Blakemore, 2005). A third position is that the head of the conjoined noun phrase is the first conjunct, and the second noun phrase is an adjunct that is attached to the first noun phrase (13c) (Munn, 1993), making the first conjunct an accessible agreement controller for partial agreement, but not the second.

13. a)



b)





Conjunctions and Comitatives

Some languages, such as Russian and several other Slavic languages, seem to have both symmetrical and asymmetrical methods of combining nouns. One way of drawing this distinction is between conjunctive ('A and B') and comitative ('A with B') (Stassen, 2000) phrases. In languages with both options, the comitative constructions express joint relationships, such as "a teacher with her students", "a trumpet with its loud noise", or "the bookstore with its coffee shop". On the other hand, the conjunctive option is taken for equal parts, such as "ketchup and mustard" or "the bookstore and neighboring shoe store". With comitatives, agreement is either with the head noun, or a pronoun is inserted that restates the subject and causes plural agreement (e.g., "the bookstore with its coffee shop, they...") (Citko, 2005). English does not regularly use two separate methods of conjunction to distinguish between comitative and conjunctive meanings, although prosody can be used to disambiguate by making the first conjunct much more prominent, and comitative interpretations of conjoined noun phrases are possible.

Single Conjunct Agreement

One of the motivations for the proposed asymmetrical structure of conjoined noun phrases is the existence of Single Conjunct Agreement, in which the verb (or other agreeing element) agrees with only one of the two conjuncts. This occurs most often when the subject

follows the verb, and agreement is with the first (closest) conjunct³. Some languages that allow first (closest) conjunct agreement with postverbal subjects include Albanian (Morgan, 1984), Russian (for conjunctions, not only comitative expressions), Cassubian (west Slavonic), and some Arabic dialects (Corbett, 2000). While closest conjunct agreement occurs most often with postverbal subjects typologically (e.g., Russian (14a)), it can occur in some languages with preverbal subjects as well (e.g., Cassubian (14b)). With preverbal subjects, the data for closest conjunct agreement are relatively sparse, and agreement with the closest conjunct is a much less frequent option than full agreement (Corbett, 2006). In the Russian example (14a), the verb is masculine-singular, agreeing with the closest noun, “kostjum”, which is also masculine-singular. The Cassubian pattern (14b) also shows closest conjunct agreement, but the closest conjunct, “strach” is preverbal.

14. a) Teper' na nej byl sinij kostjum i novaja belaja bluzka. (Russian)

Now on her was.MS (dark)blue dress.MS and new white blouse.FS

“She was now wearing a blue dress and a new white blouse.”

b) Odraza i strach czierowól jego postępkama. (Cassubian)

revulsion.FS and fear.MS directed.MS his actions

“Revulsion and fear directed his actions.”

There are a few languages, including Slovene, which have first (furthest) conjunct agreement (15), although this option is rare and occurs as a less frequent pattern in languages that also allow agreement with the nearest conjunct (Corbett, 2000).

³ This generalization holds for head-initial languages. Although some work has begun to explore single conjunct agreement with head-final languages (Bhatia, 2007), more work is needed to explore the relationship of headedness to Single Conjunct Agreement.

15. knjige in peresa so se podražil-e. (Slovene)

book.F.PL and pen.N.PL AUX.PL REFL got.dear-F.PL

“books and pens have become more expensive”

English is not generally characterized as exhibiting closest conjunct agreement (but see Munn, 1999, who argues that English shows first conjunct agreement with “there” existentials), although a few instances have been documented. (Example (16) was taken from Corbett, 2000.)

16. “The conditions and everything else was in their favour,” Dalglish said with a straight face, “so it’s credit to the lads that they dug in so well and got a result.” (*The Guardian* (Sport) 26.1.98, p.1)

Word Order Effects

One dominant question is how this option of first conjunct agreement arises and why it primarily occurs with postverbal subjects. A related question has to do with how much the structure, or word order, of a sentence governs agreement relationships. Cross-linguistically, preverbal subjects behave differently than postverbal subjects. Whenever a language displays an option of partial agreement, it is never available for preverbal subjects unless it is also available for postverbal subjects⁴, indicating that first conjunct agreement with postverbal subjects is the less marked pattern. One such language with a word order asymmetry is Russian. Corbett (2006) traced the use of predicate agreement with conjoined noun phrases in Russian from a corpus of literary texts (1930-1979), and he found that preverbal conjoined subjects were much more likely to induce plural agreement than postverbal conjoined subjects (95% plural agreement with controller preceding, compared to 53% plural agreement with the controller following).

⁴ However, if partial agreement on preverbal subjects but not postverbal subjects was discovered as a grammatical option, this would provide a valuable piece of data. Particularly, the headedness and overall structure of the language would provide additional evidence as to the nature of partial agreement.

In general, linear order plays an important role in agreement relationships, not only with conjoined subjects but also with single subject head nouns as well. English has much more rigid word order than Russian, so postverbal subjects are less frequent. However, pre-posed prepositional phrases provide an environment in which verbs precede their subjects. Evidence for the acceptance of singular agreement with inverted prepositional phrases such as (17a) and (17b) comes from a survey conducted on Canadian English speakers (Smallwood, 1997), in which participants provided number-marked verbs. In this survey, 41% of responses for present tense, inverted locative expressions, contained singular verbs when the subject noun was plural.

17. a) On the center of the page is two houses.

b) In the bottom is three stairs⁵.

Similarly, some speakers allow singular agreement when *wh*-words precede the verbs and subjects, providing another environment for postverbal subjects (examples in (18a-c) are from Sparks (1984)).

18. a) How's the horses?

b) When's the races?

c) What's these?

Guasti & Rizzi (2002) discussed other examples (from French and Italian) in which word order plays a significant role in determining agreement, with reduced agreement for postverbal subjects. In French, the presentational *ce* construction allows singular agreement with plural subjects (19). Italian also has instances where the option of reduced agreement is available for

⁵ For some speakers, these may be relatively more acceptable because they involve number expressions, which tend to be flexible in the agreement morphology they require (e.g., “5 dollars is all I have”). However, the relevant contrast is preverbal vs. postverbal agreement. Compare (18a) to “Two houses is on the center of the page”, which is markedly worse than the preposed-PP counterpart.

postverbal subjects (20a), but full agreement is required with preverbal subjects. (Examples (19) & (20) from Guasti & Rizzi, (2002), glosses and translations added).

19. a) C'est les filles. (French)

There be.3S the.PL girl.PL

'There's the girls.'

b) Ce sont les filles.

There be.3PL the.PL girl.PL

'There are the girls.'

20. a) Viene le ragazze. (Italian)

Come.3S the girl.PL

'Comes the girls.'

b) *Le ragazze viene.

the girl.PL come.3S

Both first conjunct agreement and other types of pre/postverbal asymmetries all are due, in part, to the “downstream effect”, meaning that in all these examples, subjects are produced after the verb, and verb morphology tends to be sparser if the verb precedes the subject (Benmamoun & Lorimor, 2006). Russian, English, French, and Italian are not the only languages that exhibit pre- and post-verbal agreement asymmetries. Other languages with similar asymmetries are Dutch (Ackema & Neeleman, 2003), Polish (Citko, 2005), Fiorentino (Brandi & Cordin, 1989), Arabic, (Bahloul & Harbert, 1993) and others.

Syntactic Accounts of Single Conjunct Agreement

We now turn to a literature review of syntactic accounts that have analyzed Single Conjunct Agreement in a wide range of languages. The analyses will be presented according to

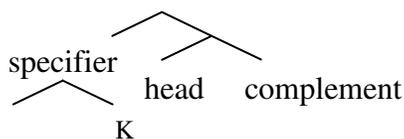
their frameworks, the first set coming from the tradition of the Principles and Parameters Framework, which includes Government & Binding (Chomsky, 1981) and Minimalism (Chomsky, 2000). I'll then turn to recent analyses within Head-Driven Phrase Structure Grammar (HPSG) (Pollard & Sag, 1994) and Lexical-Functional Grammar (LFG) (Bresnan, 2001), and finally will turn to an Optimality-Theoretic account (Legendre, Grimshaw, & Vikner, 2001).

Principles and Parameters Accounts of Single Conjunct Agreement

Within the Principles and Parameters Framework (P&P), hierarchical dependencies, and specifically c-command, (Reinhart, 1976) are central to the theory of agreement. In Chomsky (2000), c-command is defined as (20). The diagram in (21), from (Franck, Lassi, Frauenfelder, & Rizzi, 2006), shows the structure of a simple transitive clause and will help illustrate how c-command works. The subject is the specifier, the head is the verb, and the complement is the object. Embedded within the subject is a prepositional phrase modifier, which is represented by “K”.

20) X c-commands Y iff Y is dominated by the sister node of X

21)



In (21), the specifier c-commands the head and the complement, but the element “K” does not, since it is too deeply embedded.

For agreement to occur, somehow the subject must communicate its values to the verb. Within the P&P tradition, there is a functional node in the syntactic tree, AgrS, which is responsible for expressing verb agreement morphology (Chomsky, 1995). An unvalued AgrS

obtains its agreement values from the subject, which begins the derivation embedded within the VP. The subject's features are obtained through copying, a process which is called AGREE. AgrS, "the probe", then looks for "goals" in its local c-command domain that need agreement features. Since AgrS has valued features, it can recruit elements with unvalued features. The verb moves into AgrS to obtain its agreement specifications from AgrS. Then, in SV structures (including languages like English which have Subject-Verb word order), the subject moves out of the VP to the specifier position of AgrS, at which point it is in a specifier-head (spec-head) relationship to AgrS, a configuration that was considered to be relevant to agreement in some versions of Government & Binding theory (Benmamoun, 1991; Munn, 1999).

Aoun, Benmamoun, and Sportiche's (1994, 1999) Account

The issue of how to account for agreement with a single conjunct came to the forefront of syntactic debate with the exposition of Arabic data by Aoun, Benmamoun, and Sportiche (ABS) (1994). Several Arabic dialects, including Moroccan and Lebanese Arabic (MA and LA, respectively), allow speakers to use either first conjunct agreement or full agreement (with both conjuncts) with postverbal subjects, although full agreement is required for preverbal subjects. There is one major semantic condition that limits the option of closest conjunct agreement, which is that Number Sensitive Items (NSIs) that require collective readings are incompatible with partial agreement. The following sentences (22-23), taken from ABS (1994), demonstrate the relevant patterns. In (22a), the verb is masculine-singular, agreeing with the closest conjunct "Omar". Introducing the NSI "together" in (22b) makes the masculine-singular agreement impossible, so plural agreement is required. Plural (full agreement) is also required for preverbal subjects (22c). The examples in (23a-c) show that the same patterns of agreement hold in Lebanese Arabic as well.

22. a) ža ʕomar w karim. (MA)

came.3MS Omar and Karim

‘Omar and Karim came.’

b) *žā ʕomar w karim bžužhum.

came.3MS Omar and Karim together

c) ʕomar w karim žaw.

Omar and Karim came.3PL

‘Omar and Karim came.’

23. a) ʔeža kariim w marwaan. (LA)

came.3MS Karim and Marwan

‘Karim and Marwan came.’

b) *ʔeža kariim w marwaan maʕ baʕdun.

came.3MS Karim and Marwan with each.other

c) kariim w marwaan ʔežo.

Karim and Marwan came.3PL

‘Karim and Marwan came.’

Because this option of partial agreement is available only for distributive readings of subjects (in which each of the conjuncts can be interpreted as acting separately), ABS propose an explanation of clausal agreement with gapping, using the mechanism of across-the-board extraction. Therefore, agreement is with the closest (first) conjunct, rather than with the whole conjunction for postverbal subjects. If, however, the conjunction has a collective reading, as

would be required with a plural NSI such as ‘together’, then the conjoined elements are DPs, not IPs, and full agreement is required.

This analysis is strengthened by the agreement evidence from Finnish, which supports the existence of two types of conjunction, depending on level of semantic relatedness (Dalrymple & Nikolaeva, 2006). The conjunctions that are “natural” (i.e. semantically similar and involving plural NSIs) behave as plural nouns for modifying adjectives. Conjunctions, however, that are composed of two dissimilar nouns (e.g., ‘needle and haystack’), require either closest conjunct agreement or that adjectives be overtly specified for each conjunct.

Johannessen’s (1996) Account

The next major step toward analyzing partial agreement was taken by Johannessen (1996, 1998). Johannessen argues that ABS’s clausal analysis could not cover all cases of single conjunct agreement, since there are instances of single conjunct agreement in Czech and German in which bound anaphors and non-distributive predication are possible. While she allows that clausal conjunction was a possible option for some languages (such as Standard Arabic), she attributes the first conjunct agreement in Czech and German to agreement with just the specifier of the conjunction and proposes the structure for conjunctions represented in (13b) to account for agreement asymmetries. In this structure, the first conjunct is the specifier of the whole conjunction phrase, which makes it available for agreement with the verb (in verb-initial structures for head-initial languages), and creates the option of partial agreement. Whenever full agreement occurs, this is attributed to semantic influences, rather than syntactic agreement.

This analysis also extends to Swahili, which has the option of agreement with the second (closest) conjunct for preverbal subjects, as shown in the examples in (24). The second conjunct is closer to the verb than the first, and the verb enters into an agreement relationship with the

second (closest) conjunct. In the sentences in (24), this is represented through agreement in noun class between the head noun of the closest noun phrase and the verb. In (24a), “mguu” is of noun class 3, as is the verb “umevunjika”. In (24b), the closest noun “kiti” is from noun class 7, and the verb shows closest conjunct agreement as well.

24. a) Ki-ti na m-guu wa meza u-mevunjika. (Swahili)

7-chair and 3-leg of table 3-be.broken

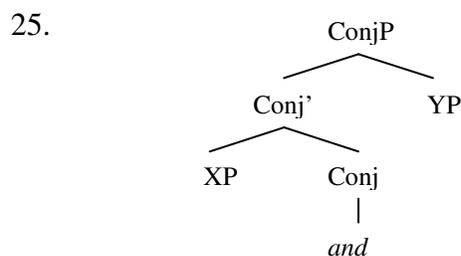
‘The chair and the leg of the table are broken.’

b) m-guu wa meza na ki-ti ki-mevunjika.

3-leg of table and 7-chair 7-be.broken

‘The leg of the table and the chair are broken.’

For languages like Swahili in which closest conjunct agreement occurs with preverbal subjects, Johannessen suggests the structure in (25), in which the specifier is the right-most element (instead of the structure in (13b)). In (25), it is the second conjunct that is the accessible agreement controller, while the first conjunct (XP) is embedded inside the conjunction phrase.



While this analysis makes a step forward by being able to account for closest (rightmost) conjunct agreement in preverbal subjects, Swahili also exhibits first conjunct agreement with conjoined objects. Since Swahili is an SOV language, this means that the furthest (leftmost) conjunct is also an accessible controller. Although this pattern occurs less frequently than the other possible patterns (agreement with the closest or with the full conjoined subject), first

conjunct agreement should be impossible if conjunctions are of the form proposed in (25) (Marten, 2000). Another important note to mention is that the semantic conditions are different for partial agreement in the preverbal and postverbal conditions: Single conjunct agreement is unavailable for preverbal subjects if the conjoined nouns are human (26), although single conjunct agreement with inanimate nouns is possible (24) with preverbal subjects. In contrast, single conjunct agreement with postverbal subjects is immune to the conditions of animacy: it is possible to have closest (first) conjunct agreement with postverbal conjoined human subjects (27) (Marten, 2000). This provides evidence that the types of partial agreement observed with preverbal and postverbal conjunctions are fundamentally different, since one type is subject to semantic restrictions while the other is not (examples from Marten, 2000). The noun class marker for singular human nouns is noun class 1, while plural human nouns belong to noun class 2. In (26a), full agreement is shown for the conjoined preverbal human subjects, and (26b) shows that closest conjunct agreement is unavailable in this context. (27a) and (27b) provide the word order contrasts. The subjects occur postverbally, and both full agreement (27a) and closest conjunct agreement (27b) are allowed.

26. a) Haroub na Naila wa-li-kuja. (Swahili)

Haroub and Naila 2-past-come

‘Haroub and Naila came.’

b) *Haroub na Naila a-li-kuja.

Haroub and Naila 1-past-come

27. a) Wa-li-kuja Haroub na Naila.

2-past-come Haroub and Naila

‘Haroub and Naila came.’

b) A-li-kuja Haroub na Naila.

1-past-come Haroub and Naila

‘Haroub and Naila came.’

This asymmetry between agreement options based on animacy presents a problem for Johannessen’s analysis, since conjoined noun phrases should be of the same hierarchical structure, regardless of their animacy. However, animacy is a common factor in determining agreement (Corbett, 2006), and should not be ignored in the description of agreement systems.

Munn’s (1999) Account

The next major analysis of first conjunct agreement (Munn, 1999) relies heavily on the role of semantics in agreement and argues against the clausal coordination, gapping analysis of Aoun et al. (1994). In Munn’s analysis, conjoined noun phrases are asymmetrical, and coordination is derived via adjunction. The reason preverbal subjects require full agreement is that they reflect specifier-head agreement, while the partial agreement that is observed is due to agreement under government. Munn calls upon the distinction between syntactic and semantic plurality to support his claim. Predicates and NSIs like ‘meet’, ‘together’, and ‘same/different’ can require semantic plurality, but not syntactic plurality, while other predicates require syntactic plurality.⁶ Munn argues that the plural NSIs in Arabic can denote either semantic or syntactic

⁶ Munn (1999) lists the predicate ‘be similar’ as requiring syntactic plurality. However, while “The group is similar” is strange, “The group is similar to each other” is permissible. Collective nouns like ‘group’ have both singular and plural readings, and even British English, which Munn claims allows semantic plurality to influence syntactic plurality, prefers singular agreement with collective nouns like ‘group’ (Bock, Butterfield, Cutler, Cutting, Eberhard, & Humphreys, 2006) In Bock et al.’s sentence completion tasks, there was 26% plural agreement on verbs with collective nouns.

plurality and that elements that require semantic but not syntactic plurality *are* allowed with first conjunct agreement, which makes the clausal agreement with gapping analysis impossible (since separating the conjoined noun phrases into conjoined clauses would not yield semantically plural subjects).

Instead, Munn presents several pieces of evidence, including the ability of the first conjunct to bind a pronoun in the second conjunct to support the adjoined DP structure for conjunctions. For both Moroccan and Lebanese Arabic, the bound pronoun is compatible with first conjunct agreement (28) & (29), which should be impossible if the conjoined elements are in separate clauses (30) (examples from Munn, 1999).

28. a) mšat kull mra w xu-ha. (MA)

left.3FS each woman and brother-her

‘Each woman and her brother left.’

b) qrat kull mra w wəld-ha qissa.

read.3FS each woman and child-her story

‘Each woman and her child read a story.’

29. a) raahit kəll mara w ʔəbna. (LA)

left.3FS each woman and child.her

‘Each woman and her child left.’

b) ʔəryit kəll mara w ʔəbna ʔəssa.

read.3FS each woman and child.her story

‘Each woman and her child read a story.’

30. *Each woman_i read a story and her_i child read a story.

As the basis for his analysis, Munn lists the following generalization: (p. 654)

31. “First conjunct agreement arises in (surface) government configurations and is impossible in (surface) specifier-head relations”

Munn also utilizes data from Schmitt (1998) that demonstrate the role of word order in agreement with participial absolutes in Spanish and Brazilian Portuguese, as further evidence for a difference between government and spec-head configurations. In these examples from Brazilian Portuguese, the participial is required to agree with the closest conjunct (32a), but if the agreeing NP is raised to the preverbal position, the participial must agree with both conjuncts (32b). In (32a), “combinada” is feminine-singular, consistent with the number marking on the closest conjunct, “a prata”. In (32b), the conjunction precedes the participle, and although the closest conjunct is masculine-singular “o ouro”, the participle shows masculine-plural agreement, “combinados”.

(Brazilian Portuguese)

32. a) Combinada a prata e o ouro, a Maria tinha o suficiente para
combined.FS the.FS silver and the.MS gold the Maria had the sufficient for
fazer um anel.
to.make a ring
‘With the silver and the gold combined, Maria had enough to make a ring.’
- b) Com a prata e o ouro combinados, a Maria tinha o suficiente
with the.FS silver and the.MS gold combined.MPL the Maria had the sufficient
para fazer um anel.
for to.make a ring
‘With the silver and the gold combined, Maria had enough to make a ring.’

Munn's analysis attributes first conjunct agreement to agreement under government, claiming the crosslinguistic correlation that first conjunct agreement arises wherever agreement under government exists. He argues against the specifier-complement structure of a coordinated subject (Johannessen, 1996) because of the general unavailability of recursivity in defining government. The structure he assumes instead for coordination is that of adjunction (13c), in which the Boolean Phrase ("and" + Conjunct2) is adjoined to the first conjunct. In VS structures, the first conjunct is governed by the verb, just as the whole conjunction is, making possible the option of First Conjunct Agreement.

van Koppen's (2006) Account

Another attempt to understand First Conjunct Agreement is based on Dutch complementizer agreement (van Koppen, 2006). In some varieties of Dutch, complementizers exhibit First Conjunct agreement, but only when the first conjunct is 2nd person singular, which van Koppen attributes to the post-syntactic lexicon. Other targets, such as verbs, which appear after the conjoined subject, show resolved (full) agreement. In (33a), the complementizer "de-s" shows second-person singular agreement, consistent with the first conjunct, which is the second-person singular pronoun "doow", but the other targets in the sentence, including the reciprocal marker "ôs" and the verb "kenne" show plural agreement. The examples are from van Koppen (2006), who incorporates data from the SAND-project (Barbiers, Bennis, De Vogelaer, Devos, van der Ham, Haslinger, van Koppen, Van Craenenbroeck, & Van den Heede, 2005).

33. a) Ich dink de-s doow en ich ôs kenne treffe. (Tegelen Dutch)

I think that-2SG [you_{SG} and I]_{1PL} each.other.1PL can-PL meet

‘I think that you and I can meet.’

b) Oa-n Bart en Liesje nie ipletn ... (Tielt Dutch)

if-3PL [Bart and Liesje]_{3PL} not watch.out

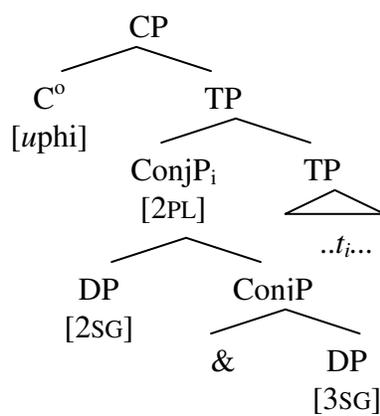
‘When Bart and Liesje don’t watch out...’

Van Koppen’s analysis is similar to Munn’s in that both the first conjunct and the full conjoined NP are visible to the agreement controller when the controller follows the target. In van Koppen’s system, potential Goals are identified during syntactic derivation, but the determination of agreement on complementizers occurs at the level of morphology when AGREE searches for a Goal in the c-command domain of the Probe. Since there is agreement both on complementizers and on finite verbs, there are two sets of unvalued phi-features, one on each Goal, which can each independently generate a search. This means that the affix on the finite verb can spell out different features than the affix on the complementizer, allowing complementizers to reflect partial agreement, while the verb indicates resolved agreement. The Goal then becomes inactive when all the unvalued features in the phase are checked (Carstens, 2003).

With coordinated subjects, the Probe on C^0 finds two possible goals – the set of phi-features on the maximal projection over both conjuncts, and the phi-feature set on the first conjunct – and AGREE relates the Probe to the Goals simultaneously. The difference, according to van Koppen, of which option is chosen (FCA or resolution) depends on the post-syntactic lexicon and on whether the language allows FCA. For languages with FCA, the relation with the first conjunct is spelled out on the complementizer, but in languages that don’t allow FCA, it is

the relation with the set of phi-features on the maximal projection that is spelled out on the complementizer. The second conjunct is not available to serve as a Goal because it is further away than the other two Goals, being c-commanded by the first conjunct in addition to being c-commanded by the C^0 (while the first conjunct and the ConjP are c-commanded only by the C^0 and thus are more “local”). Finite verbs only have one accessible Goal, so they require full agreement. The structure in (34) highlights the relationship between the elements.

34.



When two potential Goals are equally local (i.e. the ConjP and the first DP), as with complementizer agreement, agreement is determined via the subset principle (35) (Halle, 1997) as cited by (van Koppen, 2006).

35. Subset Principle

“The phonological exponent of a Vocabulary Item is inserted into a morpheme in the terminal string if the item matches all or a subset of the grammatical features specified in the terminal morpheme...Where several Vocabulary Items meet the conditions for insertion, the item matching the greatest number of features specified in the terminal morpheme must be chosen.”

The choice, then, is determined by whether the agreement features are spelled-out by overt affixes and by which option will place more specific agreement morphology on the Probe. In

Tegelen Dutch, which requires first conjunct agreement, only the 2nd singular is spelled-out with an overt affix.

Table 2.1: Complementizer Agreement in Tegelen Dutch

	SG	PL
1	det	det
2	de-s	det
3	det	det

In Tiel Dutch, full agreement (with resolution) is preferred, as would be predicted by van Koppen’s analysis, since the third-person plural marker has more specific agreement morphology than the third-person singular marker. In sentence (33b), FCA would result in third-person singular (3SG) agreement, while full agreement would result in third-person plural (3PL) agreement. (This morphological paradigm for Tiel Dutch also includes the subject pronouns, since the plural marker may be present, but assimilated into the 1PL subject pronoun, and thus not just on the 3PL.) The 2PL marker behaves like the 2SG.

Table 2.2: Complementizer Agreement in Tiel Dutch

	SG	PL
1	oa-kik	oa-me
2	oa-je	oa-je
3	oa-se	oa-n-ze

For sentence (33b), full agreement will result in more specific agreement morphology than FCA, and this determines which type of agreement will be chosen.

Van Koppen also discusses Bavarian, which only shows complementizer agreement with [2SG]-subjects and [2PL]-subjects.

Table 2.3: Complementizer Agreement in Bavarian

	SG	PL
1		
2	-st	-ts
3		

In Bavarian, both FCA and full agreement are available on the complementizer (36), although full agreement is expressed on the verb, as in the Dutch dialects (examples from van Koppen, 2006).

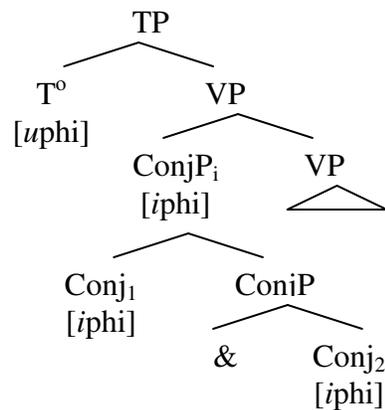
36. a) ... da_-st du und d'Maria an Hauptpreis gwunna hab-ds (Bavarian)
 that-2SG [youSG and the Maria]2PL the first.prize won have-2PL
 ‘...that Maria and you have won the first prize.’

b)... da_-ts du und d'Maria an Hauptpreis gwunna hab-ds
 that-2PL [youSG and the Maria]2PL the first.prize won have-2PL
 ‘...that Maria and you have won the first prize.’

Since both affixes are equally informative and equally local, both Goals are available when both First Conjunct Agreement and full agreement will lead to an expression of an affix (in the 2nd person).

Although the complementizer sometimes exhibits FCA, finite verbs cannot exhibit FCA in SVO- and CSVO-orders. However, earlier in the derivation, the subject was VP-internal and therefore had the same relationship to T⁰ that the raised subject has to C⁰ (37), cf. (34).

37.



The unavailability of FCA for verbs is attributed to the fact that the subject has moved out of the c-command domain of T^0 (38), which means that the first conjunct is not local to the T^0 at the level of Morphology.

38. Doow en Marie *ontmoet-s / ontmoet-e uch
 [youSG and Marie]2PL meet-2SG / meet-PL each.other2PL
 ‘You and Marie will meet each other.’

This leads van Koppen to propose that AGREE only occurs once, at Spell Out, when the derivation is concluded, and so internal structure of a copy of movement is inaccessible for AGREE. Therefore, subjects that are in the c-command domain of C^0 at Spell Out should show the possibility of FCA on the complementizer depending on the affix inventory of the language, but never on the verb. This analysis also predicts that, if the subject stays in the domain of T^0 , FCA should be possible on the verb, as is observed in Irish and Standard Arabic, although the optionality of FCA in Arabic is a puzzle that van Koppen admits is beyond the scope of his analysis.

Citko's (2005) Account

Citko (2005) also provides an account of FCA, based on data from Polish. For postverbal subjects, both Polish and Russian (Babyonyshev, 1997) have been documented as exhibiting a choice between FCA (39a) and full (resolved) agreement (39b), although agreement with the second conjunct (39c) is ungrammatical. In (39a), the verb is feminine-singular, agreeing with the closest conjunct “kobieta”. (39b) is identical to (39a), except that the verb shows plural agreement, which reflects the resolved values of the conjoined noun phrase. (39c) shows that, although the verb can show closest conjunct agreement or full agreement with postverbal subjects, furthest (second) conjunct agreement is not allowed, as the masculine-singular verb is ungrammatical (when the closest conjunct is feminine).

39. a) Do pokoju weszła młoda kobieta i chłopiec. (Polish)

to room entered-FS young woman and boy

‘Into the room walked a young woman and boy.’

b) Do pokoju weszli kobieta i chłopiec.

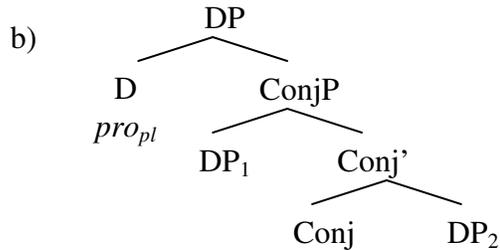
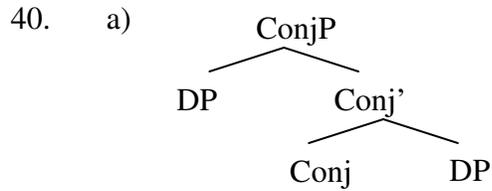
to room entered-PL woman and boy

‘Into the room walked a young woman and boy.’

c)* Do pokoju wszedł kobieta i chłopiec.

to room entered-MS woman and boy

The explanation Citko provides is that of structural ambiguity: Coordinate DPs are ambiguous between the Bare ConjP (40a) and the Plural Pronoun ConjP (40b). If agreement is with the closest conjunct, then the structure is a Bare ConjP, but if the verb reflects full agreement, this reflects that a null plural pronoun has been inserted.



While (40a) is a common analysis of conjunctions (13b), (40b) is a strategy that was also suggested by Progovac (1998) and is supported by the common occurrence of a plural pronoun restating conjoined subjects in Slavic languages (41). When the (overt) plural pronoun is used, agreement is with the pronoun, and FCA is unavailable.

41. oni, Jan i Maria... (Polish)
 they, John and Mary

Citko also argues that the pronoun comitatives (42) provide evidence for the null pronoun. With comitatives, the structure of the conjunction is overtly asymmetrical: The first conjunct is the head noun, and the second conjunct is embedded within a prepositional phrase that assigns oblique case. Verb agreement is plural, consistent with the number of the head noun. Citko suggests that the comitative can provide further evidence for the null plural pronoun, since it shows a structure that involves a pronominal, implying that this is the overt form of the pronoun that occurs with full agreement with conjoined subjects.

42. My s Jankiem tańczyliśmy

we with Jan.INSTR danced.PL

‘We (=I and Jan) danced.’

Soltan’s (2006) Account

Soltan (2006) attempts to treat the issue of First Conjunct Agreement within the Minimalist Program (Chomsky, 2000, 2001a, 2001b), arguing that the Spec-head approach to agreement can be replayed by the operation AGREE. Soltan shapes his analysis around agreement phenomena in Modern Standard Arabic (MSA), which allows FCA for postverbal subjects (43a) and (43b) but also requires that all verbs in VS order take singular agreement, although gender agreement is still required. With preverbal subjects, full agreement is required, causing dual agreement on the verb (43c). In (43a) and (43b), the verbs are singular, as is required with postverbal subjects in MSA, and the gender agreement is consistent with the gender marking on the closest conjunct. In (43b), which has a preverbal subject, the verb is masculine-dual, reflecting the resolved values of the conjoined noun phrase.

43. a) ʒaʔa Zayd-un wa Hind-u. (MSA)

came.3MS Zayd-NOM and Hind-NOM

‘Zayd and Hind came.’

b) ʒaʔa-t Hind-u wa Zayd-un.

came-3FS Hind-NOM and Zayd-NOM

‘Hind and Zayd came.’

c) Zayd-un wa Hind-u ʒaʔ-aa.

Zayd-NOM and Hind-NOM came-3MDU

‘Zayd and Hind came.’

Soltan argues that preverbal subjects are actually topics, and that they are base-generated in their surface position, linked to the VP-internal subject via a null element *pro*. Agreement with pronominal subjects does not exhibit the same word-order asymmetry as lexical subjects but instead shows full agreement (in number, gender, and person) regardless of whether the pronominals are null or overt, and regardless of whether the subjects precede or follow the verb. For postverbal conjoined pronominals, however, the verb fully agrees with the first conjunct, and not with the resolved features of the conjoined noun phrase as a whole (44). The examples in (44) show that, if subjects are pronominal, verbs do agree with postverbal subjects in MSA, producing first-person singular agreement in (44a) and third-person plural feminine agreement in (44b).

44. a) ʒiʔ-tu ʔana wa Hind-u.

came-1SG I and Hind-NOM

‘Hind and I came.’

b) ʒiʔ-na hunna wa ʔabaaʔ-u-hunna.

came-3FPL they.F and fathers-NOM-their.F

‘They and their fathers came.’

As further support for the pronominal analysis of full agreement for preverbal subjects, Soltan presents arguments for why preverbal subjects are topic-like in terms of their semantic, syntactic, and Case properties in Modern Standard Arabic. Semantically, preverbal subjects are interpreted

as topics of discourse, while postverbal subjects are associated with the default, unmarked interpretation. In Standard Arabic, indefinite nonspecific NPs cannot occur preverbally (45), which supports the topic-like property of preverbal subjects, similar to clitic-left-dislocated elements. (45a) is ungrammatical because the indefinite subject is sentence-initial. If the indefinite subject occurs postverbally (45b), the sentence is grammatical.

45. a) *walad-un kasara ?al-baab-a
 boy-NOM broke.3MS the-door-ACC
 b) kasara walad-un ?al-baab-a
 broke.3MS boy-NOM the-door-ACC
 ‘A boy broke the door.’

From a syntactic point of view, extraction across postverbal subjects is allowed (46a), while extraction across preverbal subjects is not (46b)⁷, supporting the analysis that preverbal subjects are base-generated in their surface position. In (46a), the verb “Daraba” precedes the subject “Zayd”, and extraction is allowed. In (46b), the subject “Zayd” precedes the verb “Daraba”, and extraction makes the sentence ungrammatical.

46. a) man Daraba Zayd-un
 who hit.3MS Zayd-NOM
 ‘Who did Zayd hit?’
 b) *man Zayd-un Daraba?
 who Zayd-NOM hit.3MS

⁷ However, some modern Arabic dialects do allow extraction across preverbal subjects. Soltan attributes this to a diachronic change in the status of SpecTP, as SV has become the unmarked order.

The evidence from Case for the topic-status of preverbal subjects is that, while postverbal subjects are uniformly nominative, preverbal subjects can have other case-assigners, such as overt complementizers (e.g. ‘ʔinna’) or Exceptional Case Marking verbs. Soltan therefore assigns the following structures to account for postverbal (47a) and preverbal (47b) subjects, and he considers preverbal subjects to be base-generated in SpecTP, while postverbal subjects are VP-internal:

47. a) VS: $[_{TP} T+[v^*+V] [_{v^*P} DP t_{v^*} [_{VP} t_V YP]]]$

b) SV: $[_{TP} DP T+[v^*+V] [_{v^*P} pro t_{v^*} [_{VP} t_V YP]]]$

Full agreement for preverbal subjects is then attributed to the presence of a pronominal subject, while partial agreement in the VS order can be attributed to a default agreement morpheme on Tense (T). The null pronominal requires full agreement because of the Pro Identification Requirement (McCloskey, 1986), which Soltan has reformulated as an interface condition in Minimalist Theory. This requires *pro* to be identified at the interface through identification with a head that has complete phi-features associated with *pro*, and agreement has to be full for *pro* to be identified.

Like Munn (1993, 1999), Soltan assumes that conjoined DPs are asymmetrical structures formed by adjunction. Soltan additionally assumes that adjunction occurs via an operation of late-Merge, and therefore noncyclically (cf. (Lebeaux, 1988)). This post-cyclic approach to adjunction is supported by the difference between the binding of complements and adjuncts (48) & (49). Controllers inside adjuncts seem to violate Binding Condition C, but coreference is still possible.

48. Which picture $[_{COMPLEMENT\ of\ Bill}_i] [_{ADJUNCT\ that\ John}_j\ liked]$ did he $_{*i/j}$ buy?

49. a) Which claim [_{COMPLEMENT} that John_i was asleep] was he_{*i} willing to discuss?
 b) Which claim [_{ADJUNCT} that John_i made] was he_i willing to discuss?

Soltan’s explanation for why there is gender (but not number) agreement for postverbal subjects is that person and number may have default values, but gender is not part of the phi-complex on T (being bundled with the features called “Class”) and is therefore able to probe separately for features under Agree. He also suggests that T may have an EPP feature, which would motivate full agreement with preverbal subjects. Full agreement is represented in (50), where ‘#DP#’ represents the conjoined DP that has resolved agreement. The whole conjoined phrase is base-generated in SpecTP, which makes FCA impossible.

50. [_{CP} C [_{TP} #DP# T_{PHI/CLASS/EPP} [_{v*P} *pro* v* [_{VP} ...]]]]
 |
 | AGREE ↑

The difference between FCA and full agreement in the dialects like Moroccan and Lebanese Arabic, according to Soltan, is whether adjunction happens early or late. The derivation for FCA in VS order is shown in (51), in which AGREE is valued prior to adjunction. The sentence being derived is “Read Mary and John the book”. In (51a), the derivation begins with the VP-internal subject ‘Mary’ and the unvalued phi-features on the verb. Then T is merged, inducing AGREE between T and ‘Mary’ (51b). Postcyclically, the adjunct ConjP ‘and John’ is late-Merged to the DP, at which point the feature resolution rules apply to the conjunction, computing the phi- and class-features of the conjoined DP, which will license elements denoting semantic plurality (51c).

51. a) [_{v*P} Mary v* [_{VP} V ...]]
 b) [_{TP} T [_{v*P} Mary v* [_{VP} V ...]]]
 |
 | AGREE ↑
 c) [_{TP} T [_{v*P} [#DP# Mary [_{ConjP} and John]] v* [_{VP} V ...]]]

Summary of Principles and Parameters Accounts

These Principles and Parameters have proposed a wide range of mechanisms to account for single conjunct agreement, from clausal coordination with gapping (Aoun et al., 1994), to insertion of a null plural pronoun (Citko, 2005; Progovac, 1998), to late-adjunction (Soltan, 2006), to locality (Munn, 1999) and information in the lexicon (van Koppen, 2006). All of these accounts assume that conjunctions are asymmetrical, and that there is only one set of agreement values for each noun, in contrast to the distinction between INDEX and CONCORD features made in Head-Driven Phrase Structure Grammar (HPSG) (Pollard & Sag, 1994) and Lexical-Functional Grammar (LFG) (Bresnan, 2001), to which we turn next.

Non-Principles and Parameters Accounts:

The following accounts of non-Principles and Parameters theories of agreement will strive to highlight the main points of a recent account of partial agreement in several major frameworks, including Head-Driven Phrase Structure Grammar, Lexical-Functional Grammar, and Optimality-Theoretic Syntax. In this attempt to give a relatively brief account of each formalism, of course, some important contributions may have been excluded.

Agreement in Lexical-Functional Grammar

In Lexical-Functional Grammar (LFG), there are two basic parallel modes of representation, a functional structure ('f-structure'), and a constituent structure ('c-structure'). Agreement relations are captured at f-structure. The features PERS (person), GEND (gender), NUM (number), and CASE are f-structure attributes. The agreement controller has values for its grammatical features, and the agreeing elements are associated by equations that also provide agreement features. In general agreement is asymmetric – the controller realizes a feature, while

the agreeing elements require a feature. However, the conjunctions themselves are not asymmetric: They are non-headed sets.

Items are coordinated if they are functionally equivalent. At c-structure, constituent coordination is analyzed with phrasal expansions (52), and this coordinate structure also projects a set at f-structure, which has individual conjuncts as its members. For a sentence like ‘John likes pears and hates apples’, ‘John’ satisfies the completeness and coherence requirements for the verb in each conjunct, giving the c-structure in (52), where the VP could be replaced by any type of conjoined element:

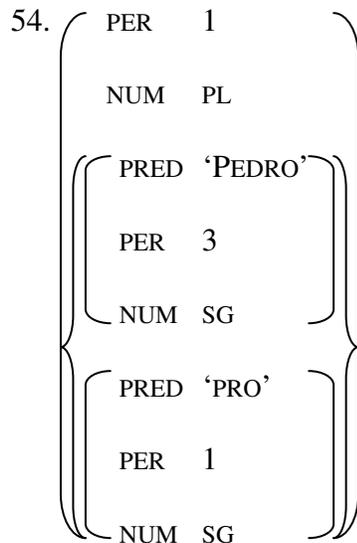
$$52. \quad \text{VP} \rightarrow \text{VP}^+ \quad \text{Conj} \quad \text{VP}$$

$$\quad \quad \downarrow \in \uparrow \quad \quad \downarrow \in \uparrow$$

Since the coordinated structures are non-headed, there is no percolation from the individual categories to a node dominating a construction, meaning that lexical properties are not shared across the coordination. Similarly, no external syntactic requirements percolate down to the conjoined items, but grammatical information does distribute to all members of the set (except, perhaps for Case, which varies depending on the language). Therefore, the individual conjuncts should be able to differ in their lexical properties, and agreement between the subject and the verb should be highly variable in the absence of external syntactic requirements.

Dalrymple and Kaplan’s (2000) representation of the coordination in (53) is that of a hybrid structure (54), where the features of the whole are obtained via a computation from the features of the conjuncts, and the verb agrees with the whole coordinate subject.

53. José y yo hablamos. (Spanish)
 José and I speak-1PL
 ‘José and I are speaking.’



Dalrymple and Kaplan distinguish between the different types of agreement features, treating number resolution as semantic in nature, but providing language-specific resolution rules for person and gender features. Resolution is set union, and the resolution rules exist as annotations, specifying how features are resolved in a particular language. At f-structure, the distributive properties of coordination are distributed over members of the set, and the non-distributive properties hold of the set (coordinate structure) itself.

Sadler’s (2003) LFG account

Sadler’s (2003) account, which is based on Welsh, is just one of several recent proposals for how to account for First Conjunct Agreement in Lexical-Functional Grammar. (See (Dalrymple & Kaplan, 2000; Dalrymple & Nikolaeva, 2006; Peterson, 2004) for other proposals.)

Welsh has a rich agreement system for pronominals (overt or covert) that involves agreement in person and number on finite verbs, and agreement in person, number, and gender on non-finite verbs, nominals, and prepositional heads. All non-pronominal arguments take 3rd person singular agreement, but heads agree with the first conjunct of a conjoined subject if it is

pronominal (55). Prepositions also show agreement when they have pronominal objects, and with coordination, the preposition agrees with the closest conjunct (56). This agreement pattern holds, regardless of semantic plurality, bound pronouns, or other number-sensitive items. In (55a), the first conjunct is non-pronominal, and the verb exhibits third person masculine-singular agreement. In (56b), the closest conjunct is pronominal, causing closest conjunct agreement. (56a) shows that closest conjunct agreement can appear on prepositions if the closest conjunct is pronominal, (56b) shows that the closest conjunct has to be pronominal for agreement to occur, and (56c) shows that, when both nouns are pronominal, agreement is with the closest conjunct.

55. a) Roedd Mair a fi i briodi. (Welsh)

was-3S Mair and 1S to marry

‘Mair and I were to marry.’

b) Roeddwn i a Mair i briodi.

was-1S 1S and Mair to marry

‘I and Mair were to marry.’

56. a) Roedd Wyn yn siarad amdanat ti a Siôn.

was.3S Wyn PROG speak about-2S 2S and Siôn

‘Wyn was talking about you and Siôn.’

b) Roedd Wyn yn siarad am Siôn a thithau.

was.3S Wyn PROG speak about Siôn and 2S

‘Wyn was talking about Siôn and you.’

c) Roedd Wyn yn siarad amdanom ni a nhw.

was.3S Wyn PROG speak about-1PL 1PL and 3PL

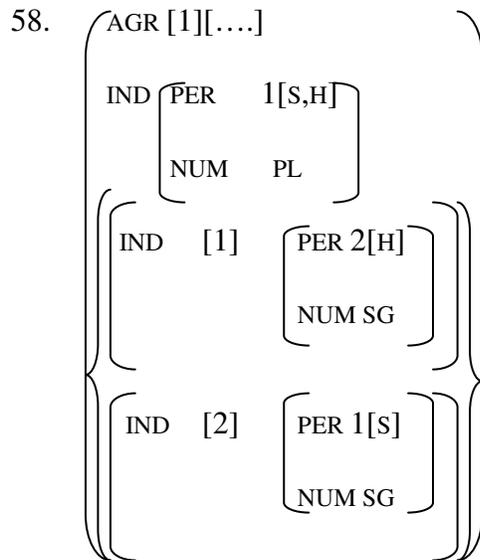
‘Wyn was talking about us and them.’

Sadler (2003) calls for a coordinate structure that has two sets of features to account for the patterns of FCA and full agreement – one resolved, one not. The unresolved set of features, which are equivalent to those on the first conjunct, is relevant to head agreement. The resolved set of features is used for agreeing with subsequent pronouns and reflexive anaphors, predicate adjectives and nominals. This means that the f-structure has two sets of (non-distributive) agreement features. IND represents the resolved features, while AGR represents the features that were provided by the first conjunct. These are similar to the features “index” and “concord”, which are frequently used in HPSG analyses of agreement (Pollard & Sag, 1994; Wechsler & Zlatić, 2003), with “index” agreement being more semantic in nature, while “concord” agreement reflects the morphological values of the agreeing nouns. Because of the nature of conjoined noun phrases, in which the values for the whole conjunction are gathered through a process of resolution, only index agreement is possible with the full conjunction, and agreement with morphological features would only be satisfied by one of the conjoined nouns. For sentence (57), the f-structure is given in (58). The majority of agreement processes are sensitive to IND features, although both IND and AGR features are present on all nominal feature structures. For non-conjoined subjects, these features (IND and AGR) are identical.

57. Daethost ti a minnau. (Welsh)

Came-2s 2s and 1s

‘You and I came.’



Agreement in Head-Driven Phrase Structure Grammar

Like LFG, Head-Driven Phrase Structure Grammar (HPSG) makes a distinction between index and concord features, but in this system, individual nouns have index and concord features that can differ in values (Pollard & Sag, 1994; Wechsler & Zlatic, 2003). Nouns, determiners, and attributive adjectives carry concord features, which contain the attributes of case and gender, and mark NP-internal agreement. Index agreement, which accounts for subject-verb agreement, involves agreement in number, gender, and person and is more semantic in nature, relating to the semantic possibilities of the associated noun (but not specifically the individual speaker's notional valuation, which can be captured with "pragmatic" agreement). This distinction accounts for the behavior hybrid nouns (Corbett, 1991), where the agreement values differ between the noun-phrase internal and noun-phrase external agreeing elements, such as between the attributive adjective and verb that agree with a noun. In (59), "Majestad Suprema" is grammatically feminine, yet it has a male referent. The pronoun "Su" reflects the grammatical

number of the head noun, but the adjective “contento” shows masculine agreement, consistent with the referential properties of the noun phrase (example from Villavicencio et al., 2005, p.3).

59. Su Majestad Suprema esta contento. (Spanish)

Pron.F Majesty Supreme.F is happy.M

‘His Supreme Majesty is happy.’

Since HPSG is an agreement-matching system, in which the number of the subject agrees with but does not determine the agreement properties of its modifiers, the goal of analysis is not how the features are achieved, but rather how they match. This means that, if the subject provides different agreement options, the modifiers have several opportunities for agreement to occur.

HPSG (Villavicencio, Sadler, & Arnold, 2005) Account

This account of First Conjunct Agreement in HPSG is based primarily on data from Ndebele, Welsh, and a corpus study in Portuguese, which together present some significant challenges to the analysis of agreement. To account for the data in these three languages, an analysis needs to have options of resolution, first conjunct agreement for NP internal agreement, and mixed strategies for pre- and post-nominal modifiers, with different strategies for number and gender. Villavicencio et al. (2005) argue that this requires three types of information to be available for each conjunction – information about the left conjunct, the right conjunct, and the conjunction as a whole.

Ndebele has closest (second) conjunct agreement, which Moosaly (1999) accounted for by proposing that the index features of the coordinate structure are identical to the features of the last conjunct. However, this account is insufficient for languages such as Welsh, which can have mixed agreement. In mixed agreement pre- and post-nominal controllers access different agreement features (60), example from Sadler (2003). The sentence-initial verb shows first

person singular agreement, consistent with the features on the first conjunct. The agreeing clitic that comes after the conjoined subject, however, shows first person plural agreement, consistent with the resolved features of the whole conjoined noun phrase.

60. Dw i a Gwenllian heb gael ein talu (Welsh)
be.1S I.1S and Gwenllian.3S without get Cl.1PL pay
'Gwenllian and I have not been paid'

Portuguese also has instances of mixed agreement. In Portuguese, determiners and adjectives agree in concord (gender) with the nouns they modify. With coordinated subjects, mixed gender coordinated structures can trigger different agreement patterns, depending on the position of the target. Postnominal adjectives can show three patterns of agreement: resolution (61a), closest (second) conjunct agreement for all features (61b), and closest conjunct agreement for gender and resolution for number (61c). According to their corpus study, resolution was the most frequent strategy used, while closest conjunct agreement (in gender) on the postnominal adjective was used for 17% of plural conjoined NPs and 5% of singular conjoined NPs (Villavicencio et al., 2005). In (61a), the postnominal adjective shows masculine-plural (resolved) agreement. In (61b), the postnominal adjective agrees with the closest conjunct and exhibits feminine-singular agreement. In (61c), the modifiers before each of the individual conjuncts agree with them individually, resulting in masculine-singular and feminine-singular agreement, respectively, but the sentence-final verb is feminine-plural, agreeing with the closest conjunct in gender but with the whole conjoined noun phrase in number agreement.

61. a) o homem e a mulher modernos (Portuguese)

the.MS man.MS and the.FS woman.FS modern.MPL

‘the modern man and woman’

b) estudos e profissão monástica

studies.MS and profession.FS monastic.FS

‘monastic studies and profession’

c) todo o constrangimento e a dor sofridas

all.MS the.MS embarrassment.MS and the.FS pain.FS suffered.FPL

‘all the embarrassment and pain suffered’

Prenominal modifiers are more complicated, and they require closest conjunct agreement, at least for gender (62a), while resolution in number is the preferred grammatical option (62b). (There are a few attested cases in which closest conjunct agreement in number may be possible, and which are acceptable to some speakers (62c).) In (62a), the prenominal modifiers agree with the first conjunct in gender, and since the first conjunct is plural, it is not possible to diagnose the source of the number agreement. In (62b), the prenominal modifiers are masculine-plural, even though the conjoined nouns are singular, showing number resolution. (62c) provides a contrast to (62b) in the number marking on the prenominal determiner. Although plural agreement (62b) is the more frequent option, (62c), which shows first conjunct agreement in number, is acceptable to some speakers.

62. a) suas próprias reações ou julgamentos (Portuguese)

his.FPL own.FPL reactions.FPL or judgments.MPL

‘his own reactions or judgments’

b) Os prováveis diretor e ator principal são Gus Van Sant

the.MPL probable.PL director.MS and actor.MS principal.MS are Gus Van Sant

e Johnny Deep [sic], respectivamente.

and Johnny Deep, respectively

‘The likely director and main actor are, respectively, Gus Van Sant and Johnny Deep.’

c) o chefe e vice-chefe estavam na reunião.

The.MS chief.MS and vice-chief.MS attended.3PL the meeting

‘the chief and vice-chief attended the meeting.’

When both pre- and post-modifiers are present, adjectives can show conflicting agreement values (63), consistent with the options provided for each type of modifier. Example (63) contains a masculine-plural determiner, consistent with the gender marking on the first conjunct, and the sentence-final adjective is feminine-plural, consistent with the gender on the second conjunct (which was also the closest to the postnominal adjective).

63. esta canção anima os corações e mentes brasileiras.

this song animate the.MPL hearts.MPL and minds.FPL Brazilian.FPL

‘This song animates Brazilian hearts and minds.’

The solution to this complex puzzle is achieved by adding two head features, LAGR and RAGR for the leftmost and rightmost conjuncts, respectively. The resolved agreement information is captured in the feature CONCORD. According to Villavicencio et al’s analysis (2005), all coordinate structures have these three agreement features, but for normal (un-conjoined)

subjects, RAGR, LAGR, and CONCORD are identical. Resolution on number is semantic, which explains why there can be instances of resolution in number and not gender. Gender resolves to feminine if all the daughters of a coordinate structure are feminine, and resolves to masculine otherwise. What options for agreement are allowed for pre- and post-nominal adjectives are stated in terms of constraints, stipulating what patterns of agreement are acceptable.

Optimality-Theoretic Agreement

Optimality-Theoretic (OT) syntax (Legendre et al., 2001) grew out of a program in which various types of phenomena could be modeled based on a set of constraints, and language variation could be explained via the relative ranking of these constraints. For agreement, one of the most important constraints is faithfulness, which constrains the verb to faithfully reflect the subject's feature values. Within this framework, other syntactic assumptions can be adopted and listed among the constraints, including a distinction between index and concord agreement (as in HPSG, LFG), and a difference between spec-head agreement and AGREE alone (as in the GB/Minimalist debate).

Badecker's (2007) Optimality Theory Account

The last type of analysis examines the choice of First Conjunct Agreement vs. Resolution in Optimality Theory, categorizing languages which allow partial agreement (agreement with a single conjunct) according to whether partial agreement is optional or obligatory and whether or not collective predicates and anaphor binding are incompatible with partial agreement. Badecker's approach is based upon Legendre's (2000a, 2000b) suggestion that optimality-theoretic constraints optimize over syntactic and PF relations simultaneously, which allows linear and hierarchical properties to interact.

Badecker's (2007) proposal also hinges upon a distinction between concord and index agreement, following Wechsler and Zlatić (2000, 2003). He suggests that languages differ in whether they compute agreement based on index or concord features and that partial agreement emerges as the optimal solution when the agreement requirements cannot be satisfied by the conjoined subject as whole (e.g., when agreement is computed based on concord, but the conjoined NPs do not have concord values, so agreement is with the concord values of one of the conjoined nouns). Evidence from French conjoined noun phrases shows the difference between concord and index agreement: Epicene nouns normally exhibit concord agreement (64a-b), but when epicene nouns are conjoined, verb agreement operates based on the resolved values of the referent, rather than on the morphological gender of the nouns themselves (64c-d). DP-internal agreement (such as that on the determiner) is constant, demonstrating that the morphological properties of the epicene nouns did not change when they were embedded within conjunctions (examples from Wechsler and Zlatić (2003)).

64. a) Le mannequin est assis (*assise) dans le coin. (French)

the fashion model is sitting.MS (*sitting.FS) in the corner

'The fashion model is sitting in the corner.'

b) Les sentinelles barbues ont été prises (*pris) en otage.

the sentries bearded.FPL were taken.FPL (*taken.M) in hostage

'The bearded sentries were taken hostage.'

c) Le mannequin et sa maquilleuse sont assises (*assis) dans le coin.

the fashion model and her make-up artist are sitting.FPL (*sitting.M) in the corner

'The fashion model and her make-up artist are sitting in the corner.'

d) La sentinelle et sa femme ont été pris (*prises) en otage.
the sentry and his wife were taken.M (*taken.FPL) in hostage
'The sentry and his wife were taken hostage.'

Badecker's explanation behind partial agreement (65) is based upon the idea that conjoined noun phrases can *lack* index or concord features.

65. Feature Principle for Partial Agreement (FPPA): *partial agreement with a conjoined NP is possible only when the conjoined phrase as a whole lacks the agreement features of the type the agreement relation requires (i.e., concord or index features).*

In languages that calculate agreement based on concord features, such as Welsh (which Badecker terms an 'M-type' language because agreement is based on morphological (concord) features), partial agreement is obligatory (if the first conjunct is pronominal) and does not conflict with anaphor binding or collective predicates (Sadler, 2003). In fact, if there is a bound anaphor, it reflects the resolved values for the whole conjoined NP, even though verb agreement is with just the first (pronominal) conjunct. Partial agreement with M-type languages therefore carries no interpretive constraint, and anaphor binding is possible based on (resolved) index values.

Other languages, such as Moroccan and Lebanese Arabic and Modern Greek (which Badecker terms 'I-type' languages), compute agreement based on index features of the nearest conjunct when partial agreement is observed (i.e., when the conjoined NP is unindexed, and the verb has to access the first conjunct to obtain an index value). Partial agreement for I-type languages is therefore only possible with distributive interpretations of conjoined NPs. For bound anaphors and collective interpretations, agreement is computed on the index value of the whole conjoined NP, which if present, means that the conjoined NP is indexed and incompatible with partial agreement.

The Arabic dialects also place a word order restriction on partial agreement: Partial (single conjunct) agreement is only allowed in VS word orders. However, in Modern Greek, partial agreement is also possible when the subject precedes the agreeing (adjectival) predicate (66) (Tantalou & Badecker, 2005)⁸. In (66a), the sentence-initial adjective shows an option of either masculine-singular (closest conjunct) agreement or full agreement, which results in neuter-plural agreement. In (66b), the adjective follows the subject, and it shows the same two options of agreement as in (66a), but in this case, the closest conjunct is feminine-singular, so the adjective can show feminine-singular agreement. The other option, full agreement, results in neuter-plural agreement, just as with the prenominal adjectives in (66a).

66. a) Gematos/Gemata kosmo itan o dromos kai i plateia. (Greek)

Full.MS/NPL of.people be.PRES the.MS road.MS and the.FS square.FS

‘Full of people are the road and the square.’

b) O dromos kai i plateia itan gemati/gemata kosmo.

The.MS road.MS and the.FS square.FS be.PRES full.FS/NPL of.people

‘The road and the square are full of people.’

Alignment constraints select the closest conjunct, making closest conjunct agreement (rather than furthest conjunct agreement) the preferred option. Within Badecker’s system, there are two crucial agreement relationships: spec-head agreement and agreement under extended projection, with concord and index constraints for each type (i.e., $\text{Agr}_{\text{concord}}$, $\text{ExtAgr}_{\text{concord}}$, $\text{Agr}_{\text{index}}$, $\text{ExtAgr}_{\text{index}}$). An additional constraint for Arabic specifies that NPs in SpecCP must bear their own index, which would account for the pattern of full agreement with preverbal subjects (while allowing partial agreement in the same configurations in Modern Greek).

⁸ However, there is a question over whether this option of partial agreement extends beyond predicate adjectives to all preverbal subjects (Badecker, 2007).

The differences between languages are attributed to the ranking of constraints and the types of agreement that are available. For example, M-type languages calculate agreement based on concord, and if concord agreement is ranked above index agreement in the language, partial agreement will be obligatory (since conjoined noun phrases do not have concord features, which only exist on the conjoined nouns themselves). I-type languages use index agreement, and the option of partial agreement occurs when the index values are missing. Therefore, partial agreement is only available in languages that allow unindexed conjoined NPs and in sentences without indexed conjoined NPs (as is possible with distributive interpretations and when there are no bound anaphors). Since agreement in Welsh is only with pronominal elements, there is an additional constraint to specify agreement for pronominal DPs.

There are a few languages, such as Czech and German, which have optional partial agreement that is not susceptible to semantic constraint (Johannessen, 1996). Badecker deals with these languages by claiming that they have two equally-ranked constraints, $\text{ExtAgr}_{\text{index}}$ and $\text{ExtAgr}_{\text{concord}}$, and that agreement with the nearest conjunct leads to no more violations than agreement with an indexed conjoined NP. Table 2.4, from Badecker (2007), makes the ranking of these constraints explicit. This Tableau shows his ranking for postverbal indexed and unindexed conjoined NPs in Czech and how both partial agreement and full agreement should be possible.

Table 2.4: Agreement Rankings with Postverbal (a) Indexed and (b) Unindexed

Conjoined NPs in Czech (from Badecker, 2007)

(a) ⁹ $V_{[f]}[NP_{[a;i]} \& NP_{[b;j]}]_{[\emptyset;k]}$	ALIGN[S,T]	EXTAGR _{IND}	EXTAGR _{μ}	NOFEATS
$f = a$		*		*
$f = b$	*!	*		*
$f = i$		*	*!	*
$f = j$	*!	*	*	*
$f = k$			*	*
$f = dft$		*	*!	
(b) $V_{[f]}[NP_{[a;i]} \& NP_{[b;j]}]_{[\emptyset; \emptyset]}$	ALIGN[S,T]	EXTAGR _{IND}	EXTAGR _{μ}	NOFEATS
$f = a$		*		*
$f = b$	*!	*		*
$f = i$			*	*
$f = j$	*!		*	*
$f = k$		*	*!	*
$f = dft$		*	*!	

A typology of languages is derived via a relative ranking of constraints, and the agreement options are complex, requiring a theory that can encompass the typological variations.

One additional issue that Badecker begins to discuss is how the semantics of the nouns themselves can impact agreement. Icelandic shows noun type effects, such that some speakers

⁹ Because this is a postverbal subject, EXTAGR is operating rather than Spec-Head agreement (AGR). ALIGN serves to ensure that partial agreement operates with the closest conjunct. “ μ ” is the symbol used to indicate morphological agreement, or concord. The NOFEATS constraint provides the option of default agreement.

allow partial agreement, but only with conjoined non-countable (abstract) nouns. This leads Badecker to suggest that properties such as countability, animacy, specificity, and definiteness can serve as conditions on the index of the conjoined NPs, an admission that semantic issues can complicate the picture even further. One attested type of partial agreement that Badecker does not account for is first (furthest) conjunct agreement with preverbal subjects, as is attested in Slovene, Latin, and a few other languages (Corbett, 2006). However, Badecker does make a large step in being able to account for mixed agreement and for the typological variations, capturing the differences in the behavior of languages with regard to single conjunct agreement.

Summary of Syntactic Analyses

All of the syntactic theories outlined above have to account for the typological differences between the languages with partial agreement. They all need to explain how it is that, at some point, individual conjuncts become accessible to agreement relationships. They also need to account for the conditions of linearity and proximity that make partial agreement possible. And finally, these accounts need to be able to explain the differences between languages in which partial agreement is compatible with collective readings/bound pronouns and the languages in which partial agreement implies interpretive constraints. One of the major difficulties in formulating a syntactic explanation is the wide range of typological differences, as well as the instability of the judgments, as there are questions about whether partial agreement is ever preferred in Icelandic, whether Czech and German really are insensitive to semantic plurality, and whether partial agreement in Greek is available beyond agreement with predicate adjectives (Badecker, 2007).

We next turn to psycholinguistic data, which provide a different type of evidence about the nature of the agreement system. While a typological survey gathers information about what

types of agreement are possible, psycholinguistic analyses can provide controlled settings to isolate the role of individual factors that may be relevant to agreement. Psycholinguistic studies on the production of agreement have been a highly productive area of research and can provide an important complement to typological and syntactic research.

CHAPTER 3: PSYCHOLINGUISTIC THEORIES OF AGREEMENT

Language production research investigates what factors are relevant to the computation of subject-verb agreement, which brings a helpful additional perspective to the syntactic research agenda. While syntacticians try to account for the behavior of all languages, for language variation, and for the sets of all grammatical sentences in any language, psycholinguists isolate individual factors and try to understand how, for that language, the individual factors affect speaker behavior.

Every model of language, whether it be syntactic or psycholinguistic in nature, has to capture how mental messages are mapped onto strings of sounds. Many models of language production segment the process into three levels: the message level/conceptualization, the sentence level/formulation, and the phonological level/articulation (Bock & Levelt, 1994). The sentence level is further divided into functional and positional levels, with syntactic role assignment in the functional level, and ordering being determined at the positional level. Within the sentence level/formulation, agreement relationships are formed, and models of agreement differ according to the modularity of agreement computations, and how distinct agreement is from the message and phonological levels. Bock & Levelt's (1994) model of the agreement system is largely modular, and information flow between levels is unidirectional. The main difference between Bock & Levelt's model and other, more interactive models (e.g., (Vigliocco & Hartsuiker, 2002)), is in the modularity of the system and the amount of cascading activation in between levels.

Speech errors have long been examined as windows into the mechanisms involved in speech production (cf. (Cutler, 1982; Dell & Reich, 1981; Fromkin, 1973; Garrett, 1975), among others). For example, one of the classic cases has to do with how many stages are involved in

lexical retrieval. Speech error data showed distinct patterns between word-exchange errors and phoneme-exchange errors in language production, suggesting that two separate retrieval processes were at work. In word-exchange errors, such as (1) (from (Garrett, 1980)), elements from the same syntactic category are exchanged, and the exchanges are typically between words occupying different phrases.

1. We completely forgot to add the list to the roof. ('roof' exchanged with 'list')

On the other hand, phoneme-exchange errors, such as (2), where the intended utterance was 'pack rat' (from (Garrett, 1988)), exchange segments between words, regardless of whether they share a syntactic category, and the exchanges are generally between words within the same phrase.

2. rack pat (/r/ exchanged with /p/)

This distinction between the behavior of word-exchange and phoneme-exchange errors was used as a support for a distinction between lemma retrieval (syntactic information about a word) and word form (phonological) encoding (Levelt, Roelofs, & Meyer, 1999). This insight into lexical retrieval is just one area in which speech error data can reveal information about the structure of the language production system.

Speech Errors in Agreement

The psycholinguistic study of the mechanisms involved in agreement began with the elicitation of speech errors, and has since grown to decipher patterns of grammatical agreement as well. The first major study investigated a phenomenon called "broken agreement" (Bock & Miller, 1991). Using a sentence-completion paradigm to elicit speech errors, Bock & Miller (1991) showed that non-subject nouns can intervene in normal subject-verb agreement and

“break” the relationship between the subject head noun and the verb, a phenomenon that was dubbed agreement “attraction”.

In this experimental sentence elicitation paradigm, sentence fragments (“preambles”) are presented to participants, who then repeat the preamble and complete a sentence, using a number-marked verb. Experimental preambles are generally complex noun phrases of various types, designed to test hypotheses about the factors involved in producing agreement. In Bock & Miller (1991), the preambles were complex noun phrases that involved embedded prepositional phrases (3a-b) or clauses. Participants repeated the preambles and completed sentences, producing normal agreement (4a) or agreement attraction (4b).

3. a) The key to the cabinet
- b) The key to the cabinets
4. a) The key to the cabinets was rusty.
- b) The key to the cabinets were rusty.

In agreement attraction (4b), the agreement features of a non-head noun (“interloper”) interfere in the computation of agreement, leading to agreement patterns such as, “The key to the cabinets *are...*” which have singular subject head nouns, plural interlopers, and plural verbs. This study therefore demonstrated that agreement could be broken, that the strict correspondence between noun number and verb number was vulnerable, that attraction was asymmetric between singular and plural interlopers, and that non-subject nouns could be responsible for this breaking of agreement.

Since this paradigm was introduced, researchers have tackled other questions to understand what phenomena are at the heart of broken agreement, what factors are relevant in the computation of agreement, and how agreement works in languages with more complex

agreement morphology than English. Much of the debate has centered around whether agreement is computed in one stage or two (Vigliocco & Nicol, 1998), whether agreement is primarily a lexical or notional process (Bock et al., 2004), and whether agreement is modular or computed interactively, with input from the phonology and message (Vigliocco & Hartsuiker, 2002). Several of the major findings of the agreement research program will be discussed in turn, the first being the role of markedness in attraction.

Markedness in Attraction

One of the first documented phenomena in agreement attraction was the discovery that plural interloping nouns are stronger attractors than singular interlopers, which provides evidence for the markedness of the plural form as well as for the default, unmarked status of the singular (Eberhard, 1997). As further support that singular nouns are unmarked but plurals are marked, Eberhard investigated the influence of inserting additional number marking into the sentence fragments via modifiers, using “one” as a singular marking and “several” as the additional plural marking (5).

5. a) The key to the cabinets (plural interloper)
- b) The key to several cabinets (additional plural marking on interloper)
- c) The keys to the cabinet (singular interloper)
- d) The keys to one cabinet (additional singular marking on interloper)

The rate of plural attraction was unaffected by the insertion of the plural modifier, “several”, but singular attraction was significantly more frequent when “one” modified the local noun, suggesting that markedness, and not just plurality of the interloper, was causing agreement attraction. Markedness is not a purely binary relationship, however – pluralizing some nouns (e.g., mass nouns and collectives) creates a highly marked plural. With increased markedness on

the plural interloper, the rate of plural attraction increases: Plural collectives (e.g., “fleets”) caused more agreement attraction than plural counts (e.g., “ships”) (Bock & Eberhard, 1993).

On the other hand, there is evidence that the contrastiveness of a plural feature (meaning, the existence of both singular and plural forms) plays a role in agreement. There is a type of plural noun that can either have plural (e.g., “soap suds”) or singular meanings (e.g., “scissors”), called pluralia tantum. In experiments in English, participants completed sentences using attractors that were either regular plurals (e.g., “razors”), notionally singular pluralia tantum (e.g., “scissors”), and notionally plural pluralia tantum (e.g., “suds”) to compare the rate of attraction (Bock et al., 2001). They found that regular plurals (6a & 6c) caused the highest rates of attraction, that the notional plurality of pluralia tantum (6b & 6d) in local position did not affect the overall rates of attraction, and that the rates of plural attraction were similar for both the notionally singular and the notionally plural pluralia tantum.

6. a) The advertisement for the razors
- b) The advertisement for the scissors
- c) The color of the bubbles
- d) The color of the suds

The phenomenon of attraction is not limited to the specifications of plural and singular:

Investigations into languages with more complex number systems (e.g., Slovene) have also shown that dual interlopers cause attraction (Harrison, Hartsuiker, Branigan, & Pickering, 2004).

Therefore, there can be attraction toward various number specifications, and for grammatical gender languages, attraction towards various gender specification is attested as well, although gender attraction, which will be discussed in the next section, occurs at lower rates than number attraction.

Gender Attraction

Gender attraction also occurs in some languages and is generally independent of number attraction (Antón-Méndez, Nicol, & Garrett, 2002). In an attraction study of Spanish, Antón-Méndez et al. (2002) crossed number and gender conditions for head and local nouns and found that, while gender and number errors showed sensitivity to mismatches of the other types of features (gender errors were more likely in the Singular-Singular condition, and number errors were more likely when the genders matched), attraction in gender and number were largely independent of each other. In fact, the relative rates of number and gender attraction within languages tend to differ greatly. The rate of number attraction in Spanish has been reported at 8.4%, but the rate of gender attraction was found to be 3.0% (Antón-Méndez, 1999), (although the comparison is limited because the attraction rates were determined based on different sets of materials). In one experiment in Russian that crossed both gender and number, gender attraction was virtually non-existent, although there was 6.0% plural agreement in the Singular-Plural condition (Lorimor, Bock, Sheyman, Zalkind, & Beard, 2007). A study on gender attraction in Slovak did reveal significant effects (between 5-12%) of gender attraction when the noun phrases contained an unmarked gender (e.g. neuter) on the head noun and a marked gender (e.g. feminine) on the local noun (Badecker & Kuminiak, 2007). However, to achieve this level of gender attraction, a significant working memory load was added through a secondary memory task, since this has been shown to increase the overall rate of attraction (Fayol, Largy, & Lemaire, 1994).

Influence of Semantics on Agreement

One of the recurring themes in agreement research deals with the degree to which meaning intervenes with the agreement computation – does the message simply select the lexical

items and allow agreement to proceed from there, or can the speaker's intended message intervene in the agreement process? Although the initial studies on agreement attraction did not uncover a role of semantics on agreement (Bock & Miller, 1991), several subsequent studies have shown that, in carefully controlled conditions, effects of semantics become evident.

Grammatical Gender & Natural Gender

Languages with grammatical gender provide an opportunity to observe the role of semantics at work. Each noun is assigned a gender, and some nouns have gender markings that are purely grammatical and are not notionally motivated¹⁰, while other nouns refer to people, who have biological genders. For these nouns that have both lexical and biological genders, some nouns have lexical genders that match the genders of their referents (“congruent”), while other nouns show a mismatch between the lexical gender and the gender of the referent (“incongruent”). Vigliocco & Franck (1999, 2001) investigated whether the biological gender of a referent would affect grammatical gender agreement in French and Italian. They found that head nouns that matched in biological and grammatical gender (7a) elicited fewer gender errors on the verb than nouns with only grammatical gender (7b) (Vigliocco & Franck, 1999).

7. a) lo sposo in chiesa (Italian)

the.M groom.M in church.F

'the groom in the church'

b) il cero in chiesa

the.M candle.M in church.F

'the candle in the church'

¹⁰ One piece of evidence that gender markings can be purely grammatical is that languages can differ in their grammatical gender choices for lexical items (e.g., “key” which is feminine in Spanish (“la llave”) and masculine in German (der Schlüssel)).

Similarly, verbs that agree with nouns that can refer to either males or females (e.g., 'la vittima', *the victim* - in French) are more likely to show agreement attraction when the real-world referent of the head noun matches the grammatical gender of the attractor (Vigliocco & Franck, 2001). In Vigliocco & Franck's (2001) study, the biological gender of the head noun was provided as contextual information through sentences such as (8a). After the contextual introduction, participants received preambles such as (8b), which had head nouns that were grammatically specified for gender but could be used to refer to either males or females. Participants received the contextual information and the preamble, and then they repeated the preambles and completed sentences, using adjectives that were provided.

8. a) un camion a investito Fabio / Fabiola che correva in bicicletta ascoltando musica
`A lorry hit Fabio / Fabiola who was riding a bike while listening to music'
b) la vittima dello scontro...
`The victim of the accident...'

Overall, there were more agreement attraction errors when the *biological* gender of the head noun's referent matched the gender of the attractor, showing that the semantic properties of the noun phrase can influence agreement and that agreement is more stable when lexical and semantic properties match than when they mismatch.

Collective Nouns

The effect of notional construal can also be seen with collective nouns, which are commonly construed as either notionally singular or plural, depending on their interpretation. Singular interpretations highlight the unitary value of the collective, while plural interpretations highlight the individual members, and agreement with collective nouns is flexible, to some degree. Morgan (1984: 73) lists a few examples of collective nouns taking both singular and

plural verbs: In (9a), the committee is being referred to as a unit, so only a singular verb is possible. In (9b-c), both singular and plural verbs are permissible, and the choice is made depending on whether the individual members of the committee are being highlighted.

9. a) The committee was/*were established in 1982.
- b) The committee is/are deliberating.
- c) The committee is/are eating lunch.

When compared with non-collective head nouns (10a), collectives (10b) are more likely to take plural agreement when they are modified by plural local nouns (Bock et al., 2006), the presence of which both adds a plural interloper and increases the notional plurality of the noun phrase.

10. a) The gang leader with the dangerous rivals
- b) The gang with the dangerous rivals

However, the notional plurality of collectives in *local* noun position does not seem to have any effect on the rate of agreement attraction, as noun phrases like “the strength of the army” exhibit no increase in the rate of plural agreement over non-collective nouns in local position (e.g., “the strength of the soldier”). This provides evidence that it is the syntactic properties of the local noun and the semantic properties of the noun phrase as a whole, that are relevant to agreement, rather than the semantic properties of the individual nouns (Bock et al., 2004; Bock et al., 2001).

Distributive Noun Phrases

Moving beyond the characteristics of the individual nouns, one place to look for semantic effects on number agreement is through a noun phrase’s distributivity. Complex noun phrases can be distributive (e.g., ‘the label on the bottles’, where there is one label on each bottle) and non-distributive (e.g., ‘the label on the marshmallows’, where there is one label on the bag of marshmallows) (Lorimor et al., 2007). Distributivity correlates with notional plurality. Noun

phrases with distributive readings are also notionally plural, and several studies have tried to understand whether distributivity (through notional plurality) plays a role in agreement production. Vigliocco, Butterworth, & Semenza (1995) investigated distributivity in Italian and found that there was more plural agreement with distributive referents (e.g., ‘i numeri sulle targhe’, *the number on the numberplates*, where each numberplate has a different number) than with non-distributive referents (e.g., ‘i gatti sui tetti’ *the cat on the roofs*, where the preferred reading is of one cat that frequents many roofs). These results have since been replicated in Spanish (Vigliocco, Butterworth, & Garrett, 1996a), Dutch and French (Vigliocco, Hartsuiker, Jarema, & Kolk, 1996b), English (Eberhard, 1999), and Russian (Lorimor et al., 2007), among other languages.

Collective nouns and distributive readings are intertwined: Collective nouns can take distributive (focusing on the individuals) and non-distributive (unitary) interpretations. Humphreys & Bock (2005) manipulated prepositions inside complex noun phrases with collective head nouns to achieve distributive (11a) and non-distributive (11b) interpretations and observed the patterns of agreement that emerged.

11. a) The gang on the motorcycles
- b) The gang near the motorcycles

In (11a), the members of the gang are distributed among the motorcycles, leading to a distributive interpretation. In (11b), the preferred reading is that the members of the gang are standing in a group, near the motorcycles, which gives a unitary interpretation. In Humphreys & Bock (2005), there were more plural verbs produced after the distributive noun phrases than with non-distributive NPs, leading them to conclude that the effect of collective nouns found in previous studies could be explained by the effect of distributivity and that notional number, as

measured by distributivity, was driving the tendency to use plural agreement with collective nouns.

Imageability

Therefore, the semantic properties of the noun phrase as a whole *are* relevant to agreement, and the stronger the notional plurality of the subject noun phrase, the more likely it will be to take plural agreement. This is also evidenced through imageability, which can strengthen notional interpretations of noun phrases. Eberhard (1999) showed that imageability of the subject noun phrase increased the influence of distributivity effects. By presenting pictures of the preambles on the screen along with an auditory presentation of the noun phrase, the salience of the distributive readings was enhanced, leading to higher rates of plural agreement for the distributive Singular-Plural noun phrases.

Semantic Integration

An alternative explanation for some of the semantic agreement effects is that the ability of a noun to serve as an agreement attractor is mediated by its degree of semantic integration within the subject noun phrase (Solomon & Pearlmutter, 2004). Nouns that are highly integrated are ones in which the two elements are tightly linked in a conceptual representation, like “the drawing of the flowers”. Nouns that are not integrated are those that can co-occur together but are not in the same mental model, like “the drawing with the flowers”, where the drawing and the flowers are separate items.

Solomon & Pearlmutter (2004) tested the ability of a local noun to cause agreement attraction, based on how tightly it was semantically integrated to the head noun, and they found that nouns that were more semantically integrated in the subject noun phrase were more likely to cause agreement attraction. Their explanation was based on an activation-based model, in which

embedded nouns that were highly integrated were more active in the syntax during the planning process, and thus more able to influence agreement. For semantically integrated noun phrases (e.g., “a record with a scratch”), head nouns and local nouns would be planned in parallel (at the same time), leading to overlaps in activation timing and to interference between structures (thus, agreement attraction errors). Local nouns that were less integrated (e.g., “cloud” in “an airplane above a cloud”) could be tacked on after lexical retrieval of the head noun, making the features of the non-integrated local noun less relevant at the time agreement is computed.

Syntactic Factors in Agreement

While the research on semantic factors tries to pin down the role of the message in determining agreement, research into the syntactic factors involved in language production can provide information about how, and when, agreement is computed. The major issues are whether agreement is computed one or two stages, whether hierarchical structure plays a role, such that nouns that are embedded deeper in the structure are less accessible to agreement, and whether agreement occurs before or after linearization (Franck et al., 2006; Haskell & MacDonald, 2005; Vigliocco & Nicol, 1998).

Syntactic Embedding

One of the early findings in agreement attraction research was that the depth of embedding was relevant to the rate of agreement attraction. While the length of the subject noun phrase *alone* does not influence the rate of agreement attraction (Bock & Miller, 1991), hierarchical structure does. This has been demonstrated through several experimental paradigms. The first was from a study by Bock & Cutting (1992) which showed that local nouns embedded within relative clauses (12a) and complement clauses (12c) elicited lower rates of attraction than

local nouns embedded in prepositional phrases of equal length¹¹ (12b & d). There was more plural agreement when the plural interloper was embedded within a prepositional phrase than when the head and local nouns were separated by a clause boundary, which increases the depth of embedding for the local noun.

12. a) The editor who rejected the books
b) The editor of the history books
c) The report that they controlled the fires
d) The report of the destructive fires

The role of syntactic embedding was further explored using sentences with multiple prepositional phrases, manipulating the number of the nouns embedded in each phrase (Franck, Vigliocco, & Nicol, 2002). This also provided a natural contrast between linear distance and syntactic embedding, since local nouns that were more deeply embedded were also linearly closer to the verb. The results showed that hierarchical structure was playing a larger role than linear distance, as plural attraction was more frequent when plural nouns were situated higher in the tree structure and linearly further from the agreement target (13a) for both French and English speakers than when the plural nouns were more deeply embedded but linearly closer to the verb (13b).

13. a) *The computer with the programs of the experiment are broken.
b) *The computer with the program of the experiments are broken.

Agreement and Linearization

From the results of the sentence-embedding experiments, it is clear that agreement attraction is not purely a linear phenomenon. However, there is still a question as to the

¹¹ This has alternatively been interpreted as semantic in nature, and hinging upon the semantic integrated-ness of the noun phrases (Solomon & Pearlmuter, 2004).

directionality of agreement processing and whether linear word order matters. Is agreement calculated based on the base-generated hierarchical relationships between nouns, before they move to their final positions, or is agreement calculated after linearization? Many theories of syntax assume that declaratives and interrogatives are transformationally related, and that questions formed by subject-auxiliary inversion are derived from declaratives, with the verb moving out to the sentence-initial position. If agreement is calculated before movement, there should be no difference in the rates of attraction between declaratives and subject-aux questions. If, however, agreement is calculated after linearization, only the interlopers that linearly intervene between the head noun and the verb should be relevant, and the sentence-initial verbs should show lower rates of attraction. Vigliocco & Nicol (1998) contrasted the rate of agreement attraction for declaratives (14a) and interrogatives (14b) and found that both word orders showed plural attraction, but that there was no significant difference between the declaratives and interrogatives in the rate of attraction.

14. a) The helicopter for the flights are safe.

b) Are the helicopter for the flights safe?

Their conclusion was that agreement is computed once, immediately after hierarchical structure is established but before linearization. In other words, agreement is computed between the subject head noun and the verb before the verb moves to its sentence-initial position in interrogatives.

Further support for the hypothesis that agreement cannot occur strictly after linearization comes from speech errors collected by Garrett (1980), which show that verbal affixes can be misplaced within a sentence. Since the suffixes are correctly computed, just attached to the

wrong elements, agreement must have been computed before the linearization error occurred (15a-c).

15. a) ‘It probably get outs a little’ (intended: ‘gets out’)
b) ‘It deads end into the...’ (intended: ‘dead ends’)
c) ‘I’d forgot abouten that’ (intended: ‘forgoten about’)

While it is clear that hierarchical structure plays a role in agreement computation, it is not clear that linear order plays *no* role in agreement production. Haskell & MacDonald (2005) probed the issue of linearization further, investigating a type of sentence in which word order would be more likely to play a role in agreement. They examined disjunctions (e.g., “the boy or the girls”), which are ideal for studying issues of linear order, since both disjuncts are equally close to the verb (structurally), yet they differ in terms of linear proximity. In an offline task using preverbal subjects, participants preferred verbs that agreed with the linearly adjacent nouns, a preference that was stronger in the Singular-Plural condition (16a) than in the Plural-Singular condition (16b), which alternatively stated, is a preference toward plural agreement, especially if the closest conjunct is plural.

16. a) Can you ask Brenda if the boy or the girlss is/are going to go first?
b) Can you ask Brenda if the boyss or the girl is/are going to go first?

On-line measurements confirmed a preference toward plural agreement, especially with preverbal subjects. Postverbal subjects showed a higher preference for agreement with the closest noun – and thus singular agreement more often, especially when the closest noun was singular. The on-line measurements were conducted through two game-playing tasks, in which participants asked questions that involved disjoined nouns of various number combinations (e.g., “the clock(s) or the horse(s)”). In the preverbal subject conditions, participants formed questions

using “Can you tell me whether...” (17a). In the postverbal subject conditions, participants used Subject-Aux inversion in their question formation (17b).

17. a) “Can you tell me whether the clock(s) or the horse(s) is/are red?”
b) “Is/are the clock(s) or the horse(s) red?”

In Haskell and MacDonald (2005), participants produced 98% plural agreement for Singular-Plural structures in the preverbal subject condition (e.g., “Can you tell me whether the clock or the horses are red?”) and 72% plurals in the Plural-Singular preverbal condition. For participants who produced postverbal subjects, the difference was much greater between the Singular-Plural and Plural-Singular conditions: Participants produced 95% plurals in the Plural-Singular condition (e.g., “Are the clocks or the horses red?”) and only 2% plurals in the Singular-Plural condition. Thus, there were effects of linear proximity. The preverbal and postverbal subjects were tested in different experiments, and in both word order conditions, plurals nouns that were linearly adjacent to the verb caused upwards of 95% plural agreement, but the influence of the linearly distant disjunct depended crucially on the position of the subject relative to the verb. For disjuncts in which the furthest noun was plural, plural agreement was much more likely to appear on the verb for preverbal subjects (72%) than with postverbal subjects (2%), strengthening the argument that linear word order may be relevant to agreement.

A sentence elicitation experiment in Slovene also showed evidence for the role of linear proximity in disjunctions (and conjunctions) with preverbal subjects (postverbal subjects were not tested) (Harrison, Branigan, & Pickering, 2005). In Slovene, which has three types of number marking (singular, dual, and plural), the rate of non-singular agreement increased when duals and plurals were linearly adjacent to the verb over conditions in which the linearly adjacent noun was singular.

The linear effects of disjunctions do not challenge the role of hierarchical structure in determining agreement. Instead, they demonstrate that, when hierarchical differences are minimized, linear word order is shown to play a role. In addition to the syntactic factors involved in agreement, another factor involved in computing agreement, morphophonology, has also been difficult to pin down because of the other variables involved, including markedness, semantics, and hierarchical structure considerations. However, there is evidence that the morphophonological string does play a role in agreement, although the debate continues over whether this is feedback, in an interactive sense, contrastiveness, or whether it can be attributed to a post-agreement speech monitoring mechanism (Hartsuiker, Schriefers, Bock, & Kikstra, 2003).

Role of Morphophonology in Agreement

Sounding plural is not enough to cause plural agreement, as is evidenced by a large number of English nouns that sound plural but take singular agreement (e.g., “mathematics”, “forensics”, “semantics”, “United States”). Bock and Eberhard (1993) investigated the role of phonology and morphophonology in causing agreement attraction by contrasting preambles involving singular nouns (18a), their plural counterparts (18b), and singular nouns that were homophones to the plural forms (18c). Because their experiment was contrasting homophones, the experimental materials were presented visually, rather than through spoken preambles.

18. a) The gardener with the hoe
 b) The gardener with the hoes
 c) The gardener with the hose

They found that preambles like (18c), which are homophonous with plural forms, do not cause agreement attraction, but that the plural forms themselves do (18b).

However, “sounding plural” does seem to increase a plural noun’s likelihood of causing plural attraction, since regular plurals in local noun position cause slightly more attraction than irregular plurals (but see Bock & Eberhard (1993)). Haskell & MacDonald (2003) contrasted the behavior of regular and irregular plurals as attractors, using preambles such as (19a) for the irregular plurals and (19b) for regular plurals.

19. a) The trap for the mice

b) The trap for the rats

Since regular plural nouns were better able to cause agreement attraction, Haskell & MacDonald concluded that the phonological string *is* relevant to the computation of agreement.

In addition to influencing agreement in English, morphophonology has also been shown to play a role in regulating agreement in other languages. In Italian, nouns can take an invariant plural form (meaning that they are morphologically equivalent between the singular and plural, like the English noun “sheep”), and they are distinguished from the singular only by the form of the determiner, so number meaning is only encoded morphophonologically on the determiner, and not on the noun itself. Participants made more agreement errors when the head nouns involved ambiguous morphophonology than when the nouns were unambiguous. In (20a), the head noun is an invariant plural, and although the number is specified through the determiner, there were more agreement attraction errors for ambiguous head nouns like (20a) than for unambiguous head nouns as in (20b), in which both the determiner and the noun show overt number marking (Vigliocco et al., 1995).

20. a) la città /le città sulla collina /sulle colline (Italian)
 the.FS city / the.FPL city on.the.FSG hill.FS / on.the.FPL hill.FPL
 ‘the city/ies on the hill(s)’
- b) il viaggio /i viaggi verso l’isola /le isole
 the.MS journey.MS / the.MPL journey.MPL to the.S island.FS / the.FPL island.FPL
 ‘the journey(s) to the island(s)’

The morphological case-marking on intervening nouns influences their ability to serve as an agreement attractor in Dutch, German, Russian, and Slovak (Badecker & Kuminiak, 2007; Hartsuiker, Antón-Méndez, & van Zee, 2001; Hartsuiker et al., 2003; Lorimor et al., 2007). The case ambiguity effects were particularly strong in Slovak, where 92% of the gender errors occurred when both the head noun and local noun were ambiguous (between nominative and accusative case). In terms of their case marking, case-unambiguous determiners on subject head nouns and local nouns reduce the rate of attraction as well (Hartsuiker et al., 2003).

The effects of morphophonology have prompted several theories to explain how the phonological forms of words, affixes, and determiners, which should be determined *after* agreement occurs, influence agreement. The proposals involve mechanisms such as working memory retrieval (Badecker & Kuminiak, 2007), distributional information and constraint satisfaction (Haskell & MacDonald, 2003), speech monitoring (cf. (Hartsuiker et al., 2003; Levelt, 1989)), and interactive feedback (Vigliocco & Hartsuiker, 2002), and these proposals are tightly tied to models of agreement production, which will be discussed in turn.

Psycholinguistic Models of Agreement

Four models of agreement production will be discussed: Working Memory Retrieval (Badecker & Kuminiak, 2007), Constraint Satisfaction (Haskell & MacDonald, 2003; Thornton & MacDonald, 2003), Maximalist (Vigliocco & Franck, 1999; Vigliocco & Hartsuiker, 2002), and Marking & Morphing (Eberhard et al., 2005).

Working Memory Retrieval

The Working Memory Retrieval model for agreement production (Badecker & Kuminiak, 2007) is based upon a similar model for language processing (Lewis & Vasishth, 2005), which assumes that morpho-syntactically tagged lexical representations are the elementary units in working memory and that these lexical phrases are bundled in hierarchical arrangements. Each lexical entry, existing in hierarchical bundles in the work space, has its own combinatorial properties (as in HPSG (Pollard & Sag, 1994)). In syntactic planning, lexical entries are bound dynamically to functional and structural roles. This binding of lexical entries to grammatical roles occurs incrementally (Smith & Wheeldon, 1999), and later elements in the sentence may need to retrieve information from the previous elements, which involves working memory recall.

There is evidence that working memory influences agreement attraction and that rates of agreement errors are higher if participants are given secondary tasks. Studies of working memory have found effects of memory load on agreement in both written and spoken language. In written French, increasing the memory load of the task has been shown to increase the number of errors, and participants had a higher proportion of attraction errors if they had to count clicks while they were performing a sentence completion task than if they completed the task without an additional memory load (Fayol, Hupet, & Largy, 1999). Hartsuiker & Barkhuysen (2006) also examined

the role of working memory and agreement for spoken language by measuring memory-span of participants and comparing the results of memory-span tests to rate of agreement errors. They found that agreement errors were more prevalent with participants who had lower memory spans (low-span) than for the participants who had higher memory spans (high-span) and that low-span speakers produced more errors with increased memory load.

Applying the Working Memory Retrieval model to agreement production is straightforward, since, for forming verb agreement, the lexical subject will need to be retrieved from the working memory. Retrieval cues, such as nominative case and pre-verbal position, can aid in retrieving the correct lexical subject. However, since complex noun phrases involve multiple nouns, it is possible that multiple controllers will be retrieved, especially if they share characteristics with the lexical subject (e.g., case marking, preverbal position), making the sentence susceptible to agreement attraction, or no candidate will be retrieved at all, and causing default agreement.

Within the Working Memory Retrieval model, agreement attraction occurs when cue-based retrieval nominates the wrong noun to form an agreement relationship with the verb. The model is able to account for morphophonological influences of agreement because nouns that are ambiguous in their case-marking are more likely to be erroneously nominated than nouns that are clearly marked as non-subjects. Similarly, if head nouns are ambiguous in their case marking (between nominative and accusative case), the retrieval cue of case will be no stronger for head nouns than local nouns, causing more agreement attraction.

Badecker & Kuminiak (2007) provide an example of how the cue-based retrieval works, using the data from German demonstratives in Hartsuiker et al., Experiment 2 (2003). In German, plural demonstratives are ambiguous between the nominative and accusative forms

(*die*), but the dative plural form is distinct (*den*). Therefore, the determiners in accusative plural noun phrases are homophonous with nominative plural determiners (21a), but are distinct for dative plural determiners (21b).

21. a) Die Stellungnahme gegen die Demonstrationen (German)

the position against the demonstrations

‘the position against the demonstrations’

b) Die Stellungnahme zu den Demonstrationen

the position on the demonstrations

‘the position on the demonstrations’

A cue-based retrieval system would erroneously activate the local noun in (21a), either instead of, or in addition to, the nominative subject, since it is homophonous with a nominative form, predicting more plural attraction for accusative plural noun phrases than dative plural noun phrases, which is what they observed.

This account provides an explanation of case-ambiguities in agreement and could be supported by other findings, which show that local nouns that are logical subjects of the verb (e.g., “the album by the classical composers were praised”) are more likely to cause agreement attraction than local nouns that could not be logical subjects of the verb (“the album by the classical composers were played”) (Thornton & MacDonald, 2003). However, the memory retrieval model is incomplete in its coverage, as it cannot account for issues of notional plurality or other message-level factors that have been shown to affect agreement production.

Constraint Satisfaction

The Constraint Satisfaction model of agreement production (Haskell & MacDonald, 2003; Thornton & MacDonald, 2003) is similar to the Memory Retrieval model in that a number

of distributional factors are involved in the calculation of agreement. Built upon constraint-satisfaction models of language comprehension (MacDonald, Pearlmutter, & Seidenberg, 1994; Trueswell & Tanenhaus, 1994), this model of agreement production involves multiple graded, probabilistic constraints interacting with each other, causing alternative verb forms to compete. Instead of agreement being characterized as correct and incorrect, it is instead viewed upon a graded scale based on the level of support for a verb form, with ordinary singular nouns at one end, then distributive noun phrases, then collectives, and with plural nouns at the other end of the spectrum.

Multiple sources of information either promote or inhibit a verb form. The cues vary in their “validity” (MacWhinney & Bates, 1989), which judges how often a cue points to the correct conclusion. Verb selection is probabilistic, and the acceptability of a form should depend upon the measure of support it garners from its multiple sources of information. Grammatically singular nouns inhibit plural verbs and promote singular verb forms (e.g., “horse” would inhibit the verb form “run” while promoting the singular form “runs”), while grammatically plural nouns support plural verbs and inhibit singular verb forms. When the sources of information promote differing alternatives, as might occur with grammatically singular but notionally plural nouns, it is the interaction of the different sources of information that matters – a weak factor can play a significant role if the other factors are already divided between the choices of verb forms.

Within the Constraint Satisfaction framework, notional plurality can activate plural verb forms, as can plural local nouns and nominal plural morphology. Thus, agreement is viewed as a convergence of semantic and syntactic information. Since head nouns and local nouns both contribute to agreement in this model, the notional number valuations of local nouns should be expected to affect agreement.

The existence (and prevalence) of agreement attraction with plural local nouns is attributed to speakers' experience with pseudo-partitive constructions (e.g., 'a group of lawyers'), which can take plural agreement, and which biases the planning system to expect that plural agreement should be able to occur with singular head nouns and plural local nouns. (This lack of a similar plural-singular construction provides an explanation for why plural attraction occurs more often than singular attraction, since there no similar construction with plural heads and singular local nouns that can co-occur with singular agreement.)

As an example of how Constraint Satisfaction works, if a speaker is forming verb agreement with the noun phrase 'the key to the cabinets', the local noun receives a small, but not non-zero probability of being the agreement controller. If the local noun differs from the head noun in terms of its number marking, this means that an alternate verb form will be partially activated. Depending on the other constraints at work, the alternate (plural) verb form will occasionally be produced. Morphophonological input can come into play, just as with the Maximalist model (Vigliocco & Hartsuiker, 2002), as non-subject nouns that are homophonous with the nominative forms would have stronger activations than overtly marked non-nominative forms.

Maximal Input Hypothesis

The Maximal Input Hypothesis is similar to Constraint Satisfaction in that semantics, syntax, and morphophonology are all active in the computation of agreement. In Vigliocco & Hartsuiker (2002), a maximalist perspective is described as one in which efficiency is achieved through converging information provided at multiple levels, including later levels. In syntactic production, a distinction is made between functional and positional levels. At the functional level, the speaker's intentions are mapped onto a sentence-level frame. At the positional level,

the linguistic representation is mapped onto a serially organized frame (i.e. a mapping between a hierarchical and linear frame). In this frame, word forms are inserted in slots corresponding to linear positions, and then segments are linearized within phonological words, in prosodic groupings.

Redundancy is exploited, so semantic information might be made available, just in case syntactic information is lost, and information flows bidirectionally, with semantic information supporting accurate agreement. There is cascading activation between levels (spreading of activation to a given level before the previous level has achieved a selection), which allows for feedback as well as preactivation of upcoming units. This approach is non-modular, so all levels of information, including phonology, play a role in determining agreement. However, each level of representation has a primary source of information. For computing number agreement, which occurs at the functional level, the primary source of information is the syntactic number of the subject noun. As with the Constraint Satisfaction framework, additional sources of information are available, and their strength is weighted according to their reliability as an information source.

As an example, a noun phrase like “the label on the bottles” would receive primary number marking at the functional level from the head noun “label”, predicting singular verb agreement. However, other sources of information would also be available, which would increase the probability of plural agreement. This includes the plural number marking on the local noun, the fact that “label” and “bottles” are homophonous between nominative and accusative forms, which increases the relative activation of the plural marker through feedback from the phonological form, as well as the plural notional value that comes from the distributive interpretation of the subject noun phrase.

Marking and Morphing Model

The Marking and Morphing model (Bock et al., 2001; Eberhard et al., 2005) also provides a way to account for differing lexical and notional values in producing agreement. Notional number affects agreement through a process called “Marking”. Marking is part of the functional assembly, and it transmits number information to the syntax, which is deposited on the root of the subject noun phrase, based on the constraints from the message. The notional number in the message also selects the nouns and the lexical-morphological number properties for the subject noun phrase. However, notionally plural messages are not constrained to select *lexically* plural nouns, just nouns that are consistent with the message. Notionally plural valuations can recruit items from the lexicon that are lexically plural (e.g., “clothes”), notionally plural mass nouns (e.g., “clothing”) or collectives (“wardrobe”).

Once the lexical items are selected, the agreement process is largely controlled by Morphing, which is a part of structural integration, in which lexical and structural forms are bound together, based on the constraints from the lexicon and the syntax. During morphing, morphological information is bound to structural positions, and number-relevant features from the syntax (Marking) are reconciled with number-relevant features from the lexicon. Finally, Morphing transmits number information to verbs.

The process of Marking is important because noun number alone cannot account for the patterns of number agreement. One prime example is conjoined noun phrases (e.g., “drinking and driving”, “potatoes and onions”, “cream and sugar”), which can take either singular or plural agreement, depending on the referent of the noun phrase, even if neither of the conjoined nouns shares the number that is communicated to the agreeing element. Other examples for the need for marking come from sentences with *wh*- subjects like “which”, “who”, and “what”, which can

take either singular or plural agreement, and pronouns, which are more sensitive to notional valuation than verbs (Bock et al., 2004). The process of Morphing is important because agreement is largely constrained by lexical number, not by notional number. Even though pluralia tantum like “scissors” are notionally singular, they take plural verb agreement in English. Similarly, Morphing explains why agreement attraction is sensitive to the lexical, but not the notional properties of interloping local nouns.

The Marking and Morphing Model differentiates between notional number agreement and agreement attraction. Notional number agreement occurs when number on the subject noun phrase is reconciled in favor of the (plural) value contributed by Marking. Agreement attraction occurs when the lexical features on an interloping noun are able to achieve a plural marking on the subject noun phrase during Morphing.

With complex noun phrases, the grammatical number specification for the subject noun phrase is derived through a spreading activation process that sums the Singular-and-Plural (SAP) values of all the lexical constituents and also reconciles the SAP values with the value obtained through Marking. Both the nouns and their number-marked modifiers (e.g., “one”, “these”) have SAP values, and these values are weighted to reflect the depth of embedding inside the noun phrase, so SAP values for subject head nouns are weighted more heavily than for local nouns and their modifiers. Singular nouns have activation values that range from negative to zero, plural nouns bear a positive value for the SAP feature, and their values range depending on their level of contrastiveness (i.e., nouns that only occur in the plural, e.g., ‘galoshes’, have lower SAP values than regular plurals, e.g., ‘shoes’).

The weighting of SAP values according to level of embedding is able to capture the hierarchical effects of attraction (Bock & Cutting, 1992; Franck et al., 2002), since plural nouns

that are more deeply embedded in the tree will have smaller weights, reducing their ability to cause agreement attraction. The morphophonological influences (e.g., regular plurals causing more agreement than irregular plurals (Haskell & MacDonald, 2003), and determiners that are ambiguous between accusative and nominative case increasing the likelihood of agreement attraction (Hartsuiker et al., 2003)) can be explained through gradations in the impact of local noun number due to contrastiveness. Because regular plurals have a singular counterpart, the lexical plural features are stronger. Similarly, determiners that are ambiguous for case-marking will be less contrastive than determiners that are ambiguously nominative plural.

The conceptual information is relevant to the construction of the message, but at the point the speaker is computing subject-verb agreement, the grammatical number is primarily relevant. As described in Middleton, Bock, & Verkuilen, (2007), the thinking that is involved in formulating a message begins before speaking, usually by at least several hundred milliseconds, so the notional number valuation that was involved in the planning of the utterance may have disappeared by the time the word is uttered. When notional and grammatical number clash, the notional number value from Marking is reconciled with the lexical number values during Morphing, and lexical number is largely the victor, leading to singular agreement with sentences like (22a) and plural agreement with sentences like (22b), although (22a) denotes a plurality, and (22b) denotes values of one or none (examples from Morgan, 1984).

22. a) More than one student is...
b) Fewer than two students are...

Sentence (22a) also provides a good example of how number is computed within the Marking and Morphing model. Since ‘more than one student’ refers to multiple students, the original number value from the message is plural. The lexical items chosen that have values for

number are ‘more’, ‘one’, and ‘student’. All three items are lexically singular, having SAP values below or equal to zero. The sum of the SAP values is negative or zero, and when reconciled with the original number marking from the message (which can be overruled by the SAP values from the lexical items), the product is a singular value to be communicated to the verb.

One or Two Stages of Agreement

A large portion of the debate about the structure of the agreement production system has revolved around whether agreement is computed in one or two stages. The speech error data and attraction results mentioned above demonstrate that agreement does not occur strictly after linearization (Haskell & MacDonald, 2005). However, agreement could still occur in one step, before linearization, or it could occur in two stages. Since Vigliocco & Nicol (1998) failed to observe a difference in the rate of attraction between preverbal (“The helicopter for the flights is/are safe.”) and postverbal (“Is/are the helicopter for the flights safe?”) subjects, they hypothesized that agreement occurs before linearization, and after hierarchical structure is assigned, which was also supported by the embedded noun phrase data from Franck et al. (2002), an approach called “two-stage, agreement early”, which predicts no effect of linear word order on agreement.

However, Haskell & MacDonald (2005) did observe effects of linear word order with disjoint subjects (i.e., “NP *or* NP”), in which both of the nouns are hierarchically in the same relationship to the verb, but one is linearly proximate. Since they found a difference between the behavior of preverbal and postverbal subjects as well as an effect of linear proximity, they argued that the two-stage, agreement-early model was incompatible with their results and that a single-stage model of agreement or a two-stage, agreement-late model would be needed to

account for the effects they observed. In a single-stage model, structural assembly happens once, and hierarchical relationships, agreement and linear order are all computed in parallel. In the two-stage, agreement-late model, agreement would occur late, concurrent with linearization.

Franck et al. (2006) also observed effects of linear word order in agreement, and they proposed an interesting solution, tying the two-stage model of syntactic computation to a two-step process of agreement, as well as to generative syntactic theory. Franck et al. attributed the difference between agreement with preverbal and postverbal subjects to a two-step agreement process: “checking (AGREE)” and “verification”. In syntactic theory, the minimalist function AGREE involves the agreement probe AgrS looking for a goal with matching features within its domain of c-command. If this probe finds a goal with matching features, it undergoes a checking operation (Chomsky, 2000, 2001a, 2001b), causing agreement to occur. Franck et al. (2006) suggest an additional step, verification, which involves an additional valuing operation after the subject has moved into a strictly local Spec-head configuration (preverbal subjects), which would strengthen the agreement relationship between preverbal subjects and their verbs and lead to less variability in agreement. Alternatively, this approach can be modeled as agreement happening in two stages – once at the functional level, based on the hierarchical relationships between the lexical items, and again at the positional level, where linear word order allows preverbal subjects to verify their relationship with the verb.

Summary

These psycholinguistic investigations into subject-verb agreement have revealed several crucial pieces of information about how agreement works. First, agreement is calculated primarily based on the lexical number of the subject head noun, and all the psycholinguistic models have to account for the dominance of lexical number in determining agreement. Second,

agreement between a subject and a verb can be broken, primarily through the interference of non-head nouns (Eberhard et al., 2005). While the exact mechanism for agreement attraction is still under debate, it is clear that increasing the memory load will lead to a greater number of agreement errors and that speakers can settle on an erroneous controller (Badecker & Kuminiak, 2007; Hartsuiker & Barkhuysen, 2006). Third, the message is relevant to the agreement computation, and notionally plural items are more likely to be marked as plural (Humphreys & Bock, 2005), just as extrinsically gendered nouns (e.g., “boy”) are less likely to allow agreement errors than nouns with just grammatical gender markings (Vigliocco & Franck, 1999). Fourth, the presence of unambiguous morphophonology can strengthen agreement between a subject and a verb, while head nouns and interlopers that are ambiguous for case, number, and gender increase the incidence of agreement attraction (Hartsuiker et al., 2003), although the mechanism for the influence of morphophonology is under debate and could be attributed to memory cues, feedback, contrastiveness, or monitoring.

The following chapters present a corpus study and several sentence production experiments that explore the relative contribution of lexical number, notional valuation, and word order to agreement with conjoined subjects, with the goal of gaining a deeper understanding about the nature of the language production mechanism and the factors involved in producing agreement.

CHAPTER 4: COUNTING CONJUNCTIONS¹²

Haskell & MacDonald (2005) investigated the role of linear order in agreement using disjoined subjects (e.g., “NP or NP”), and they found that there was more plural agreement with preverbal disjunctions than with postverbal disjunctions. They also found that, with postverbal disjunctions, agreement operated almost entirely based upon the features of the closest noun. This caused them to question the conclusions of previous psycholinguistic studies that had minimized the impact of linear order on agreement production (Franck et al., 2002; Vigliocco & Nicol, 1998) and to explore what models of agreement would look like if they took into account linear order effects.

Like disjunctions, conjoined noun phrases (e.g., “NP and NP”) also lack a true head noun that is primarily responsible for the features that are communicated to the verb during subject-verb agreement, and conjunctions are optimal for uncovering effects of linear word order and proximity in language. Conjoined subjects frequently occur both in spoken and written language. Their agreement properties, therefore, can be put under scrutiny by using techniques of corpus analysis, which can reveal linguistic trends and patterns of behavior.

This corpus analysis of conjoined subjects had two primary goals. The first was to explore the general behavior of conjoined subjects in English, with the purpose of determining which linguistic factors might be relevant to agreement computation. Specifically, the corpus study was motivated by three main questions: 1) Are conjoined subjects always plural? 2) If there is variability in verb agreement, is it semantically conditioned? and 3) When one of the conjoined nouns is plural, are there proximity effects that mimic single conjunct agreement?

The second goal of the study was to provide a comparison for the experimental results (reported in Chapters 5 & 6), as a way of ensuring that the experimental results were not due to

¹² Portions of this chapter were presented at the 19th annual CUNY conference on human sentence processing.

participants' adopting task-specific strategies that would skew the data. Because sentence elicitation tasks often involve producing a string of similar sentences, this comparison of experimentally elicited spoken sentences to those from naturally occurring, random sources provides a test of whether the patterns that were observed in the experiment should also be expected to hold in naturally-occurring speech as well.

Method

3417 English sentences with conjoined noun phrase subjects were retrieved from the World Wide Web¹³ using the Linguist's Search Engine (Resnik & Elkiss, 2004), a tool that allows retrieval of sentences based on lexical content and syntactic structure. All of the sentences involving conjoined noun phrase subjects were statements with Subject-Verb word order and were hand-screened for reliability. Three main types of sentences were excluded: First, sentences were excluded if the automatic parser in the Linguist's Search Engine had misclassified the sentence, most often when the subject was not a conjoined noun phrase because it was embedded within a prepositional phrase, as in "Again, the economic interests of the third-party administrator and the customer are in conflict because of the fee structure." (source: www.ambest.com). The automatic parser was unable to judge whether two conjuncts were "the economic interests of the third party administrator" and "the customer" or whether the conjoined noun phrase was embedded within the prepositional phrase ("of the third party administrator and the customer"), leading to the necessity of hand-coding the items.

Second, items were excluded when they were judged to be unreliable because of their source or because they contained an error that would be unlikely to be committed by a native speaker of American English. While this was impossible to do with complete certainty, the two

¹³ Admittedly, the World Wide Web is a widely heterogeneous corpus that includes both spoken and written sources. As is reported in the methods section, measures were taken to ensure that the sentences pulled from the corpus were from native speakers of American English, which minimized variability.

main exclusionary criteria were international internet domain tags and non-native-like errors. We excluded any items from internet domains that were not commonly used for U.S. websites. (Included were: .gov, .org, .net, .edu, and .com; excluded were: .jp (Japan), .kr (Korea), .uk (United Kingdom), .fr (France), .it (Italy), .cn (China), and many others.) Also excluded were items in which the error signaled that the source was not using Standard American English. This was judged subjectively by the coder, and the “error” was never subject-verb agreement, but was instead some other unrelated error that caused the sentences to be judged as unreliable, including misspellings, misusing articles, noncanonical word order, or other blatant syntactic violations. For example, the sentence “The food and drink of this country are one of the things that what make it so special.” (source: www.iexplore.com) was excluded because of the string “that what”, which is likely to be either a result of a non-native English speaker or of an editing mistake, leaving the reliability of the sentence in question.

Third, sentences were excluded if there were other confounding factors: denoting a proper name (e.g., “Pride and Prejudice”), referring to an academic paper (e.g., “Chomsky & Halle”), appositives (e.g., “As national snack giants Frito-Lay and Eagle Snack...” source: www.mcclearys.com), or containing more than two conjuncts (e.g., “milk, eggs, and cheese”).

Scoring

For the sentences that were scorable, verbs were scored as singular, plural, or unmarked. (Unmarked verbs are modals, future, and past tense forms.) The number-marking on each of the conjuncts was also scored, and both the first and second conjuncts were scored as either singular or plural. These factors were coded separately to be able to test for the relative influence of number marking on the linearly proximate noun. Conjunct type was scored according to semantic (and syntactic) categories of the each of the conjoined nouns, and each noun was

classified according to only one semantic category. The categories were pronouns, animate count nouns (humans and animals), collectives, non-deverbal mass nouns, inanimate count nouns, and deverbals (nouns that were transparently derived from verbs).

The scoring criteria are summarized in the table below. The main point of these scoring criteria, as well as the exclusionary criteria, was to develop as clean a representation as possible of how conjoined noun phrases were used in contemporary American English.

Table 4.1: Summary of Coding for Corpus Study

Verb Number	Singular, Plural, Unmarked
Conjunct Number	Singular, Plural
Conjunct Type	Pronouns, Animate count nouns, Collectives, Non-deverbal mass nouns, Inanimate count nouns, Deverbals

The decision to include a separate category for “deverbal” nouns was made based on a preliminary coding of the corpus data, through which it became clear that nouns that were derived from verbs were behaving differently than those that were not. The criterion used to distinguish deverbal nouns was whether or not they had been derived from verbs using overt morphology (e.g., “statement” from “state”). Although most of the deverbal nouns took mass noun interpretations in the corpus, some were count nouns as well. For the purpose of the corpus analysis, we therefore separated deverbal nouns from the count/mass distinction, in order to gain a picture of how count and mass nouns were behaving without the influence of deverbal nouns. A follow-up experiment (Chapter 5) crossed count/mass syntax with deverbal nouns to explore how each of these factors influences verb agreement.

Design and Analysis

The factors of noun number and noun type on each conjunct were computed, using Chi-square analyses.

Results

Overall, there were 3417 sentences that were extracted from the World Wide Web. There were 742 sentences that were marked as singular or plural, and 621 that were unmarked for number. (The additional 2054 sentences were excluded because of the before-mentioned exclusionary criteria.)

Of the 742 sentences with conjoined subjects that were judged as likely to have been produced by native English speakers and which agreed with a singular or plural verb, 206 (28%) of the sentences had singular verbs, and 506 (72%) had plural verbs. In the discussion that follows, the factors of noun number and noun type will be discussed, as they were singled out as being likely candidates for influencing patterns of subject-verb agreement.

Effect of Noun Number

One factor that is likely to be significant is the lexical number marking on the conjuncts themselves. This expectation is derived from the fact that lexically plural (non-conjoined) subject nouns are almost unilaterally plural (Eberhard, 1997). When plural nouns are introduced into conjunctions, the expectation would be that the plural morphology of the conjoined noun would trigger plural agreement. Plural morphology is also more likely to correlate with plural notional number, thus increasing the likelihood of plural agreement due to notional plurality.

When one of the two conjuncts is marked as plural, the relative contribution of linearly distant and proximate plurals also provides insight into linearity effects and the relationships between the conjuncts. If both conjuncts are equally able to enforce plural agreement, this

suggests that linear proximity is not affecting the agreement process and that both nouns are equally accessible controllers. If the plurality on the first (furthest) conjunct plays a larger role in enforcing plural agreement, this suggests that the first noun is more prominent than the second, and that conjoined noun phrases are asymmetrical structures. On the other hand, if the linearly proximate conjunct has a stronger effect on the verb's plurality, this could be used as support for models in which agreement is computed linearly, since the closest noun to the verb would be plural. Table 4.2 lists the breakdown of agreement for both singular and plural verbs, depending on the number marking of the subject nouns.

Table 4.2: Number Marking on Conjoined Nouns x Verb Agreement

Conjunct Type	singular verbs	plural verbs	proportion singulars
Singular-Singular (“the dog and cat”)	196	293	0.40
Singular-Plural (“the dog and cats”)	1	90	0.01
Plural-Singular (“the dogs and cat”)	8	43	0.16
Plural-Plural (“the dogs and cats”)	1	110	0.01

A Chi-square test returns a value of 112.9 (df=(3), $p < .0001$), indicating that the noun number effect is highly relevant to the computation of agreement. Verbs were most likely to be marked as singular if both conjuncts were singular, but the Plural-Singular condition, in which the closest conjunct was singular, also reflected more singular agreement than the SP and PP conditions.

Effect of Noun Type

Descriptive studies of conjoined subjects have demonstrated that noun type often affects agreement patterns. Studies of literary texts in Russian (Corbett, 2006) and conversational Cairene Arabic (Bahloul & Harbert, 1993) have shown that conjoined human nouns are more

likely to take full agreement than conjoined inanimate nouns and that the agency of conjoined subject nouns correlates with likelihood of plural agreement. The nouns were classified according to six categories: pronouns, animate count nouns, collectives, non-deverbal mass nouns, inanimate count nouns, and deverbals. The prediction was that the conjoined nouns would take plural agreement, according to their degree of animacy and agency (which define prototypical subjects (Aissen, 1999)) and according to their notional plurality. Inanimate nouns, mass nouns, and deverbals, which have low degrees of agency, and which often take notionally singular interpretations when conjoined, will be expected to elicit more singular agreement. Each of the noun types will be briefly discussed.

Pronouns

Pronouns are strong agreement controllers. They refer to distinct entities in the discourse, and they are at the very top of many agreement hierarchies in terms of requiring full agreement (Aissen, 1999; Bahloul & Harbert, 1993; Corbett, 2006; Silverstein, 1976), especially if first or second person agreement is involved.

Animate Count Nouns

This category includes humans and animals, which also occupy some of the top slots on agreement hierarchies. Humans and animals are agentive, which makes them prototypical subjects, and when conjoined they are unlikely to take notionally singular interpretations, leading to the expectation of plural agreement with conjoined animate count nouns.

Collectives

Many collective nouns are animate, and in this analysis, animate and inanimate collectives were grouped together in the same category¹⁴. Collective nouns refer to groups of

¹⁴ In the follow-up sentence elicitation experiment, all collectives were inanimate to deal with the confounding factor of animacy in agreement with collectives.

individuals, and they are often notionally plural. This leads to the prediction that, when collective nouns are conjoined, they will lead to plural agreement.

Inanimate Count Nouns

Inanimate count nouns refer to countable objects (e.g., “table”, “broom”) and as they are less agentive than their animate counterparts, they fall lower on the agreement hierarchies (cf. Aissen, 1999). As a result, conjoined inanimate count nouns should be less likely to elicit plural agreement than animate count nouns.

Non-deverbal Mass Nouns

Mass nouns often refer to substances (e.g., “air”, “wind”), and they should be likely to co-occur with singular agreement because of their ability to elicit notionally singular interpretations. Many mass nouns are abstract, and they are able to “coalesce” with other nouns, creating complex wholes from the conjoined parts (Middleton, Wisniewski, Trindel, & Imai, 2004).

Deverbals

Deverbal nouns, many of which are events, have, by their very nature, abstract boundaries. They occur frequently in written and spoken English and were used in over half of 2000 parsed sentences elicited from the Wall Street Journal (Gurevich, Crouch, King, & De Paiva, 2006). Deverbal nouns are verb-like in their argument structure and subcategorization frames (Grimshaw, 2005; Nunes, 1993), making them more event-like than object-like, and they rarely occupy agentive roles.

While objects are easily quantified, events are more ambiguous in their notional number valuations. The event of “singing” could be done by one person, by thousands of people, for two seconds, continuously for three hours, or repeatedly, over a period of thirty years. This is

especially important because multiple events can happen at once, and they can coalesce into complex events: (“Drinking and driving” is not merely the event of drinking, followed by the event of driving, but a complex event comprised of both. “Singing and dancing” can be done simultaneously by one performer, it can be done simultaneously with one person singing and dancers in the background, or it can be done sequentially, with singing followed by dancing, and vice-versa.) Therefore, these deverbal nouns fall on the far end of the spectrum of combinability and will readily coalesce into single events, thus inducing singular verb agreement.

Table 4.3 shows the rate of singular and plural agreement, broken down by type of conjoined nouns, when both conjoined nouns shared the same semantic category. Conjoined noun phrases of mixed noun type (such as conjunctions of pronouns and animates, e.g., “you and John”)) were excluded from Table 4.3 and the chi-square calculation, and pronouns were also excluded from the chi-square calculation because of the low number of items.

Table 4.3: Noun Type x Verb Agreement

Conjunct Type	singular verbs	plural verbs	proportion singulars
pronouns (e.g., “you and I”)	0	3	0
animates (e.g., “the boy and girl”)	0	84	0
collectives (e.g., “the faculty and staff”)	0	19	0
count nouns (e.g., “the table and chair”)	28	173	0.14
mass nouns (e.g., “the dust and mold”)	41	61	0.40
deverbals (e.g., “the talking and eating”)	87	19	0.82

A Chi-square test confirmed the role of noun type in the type of agreement that is produced (Chi-square value of 208.9 (df=4), $p < .0001$).

Noun type and noun number are not independent, as mass nouns cannot be pluralized. Therefore, to insulate the factor of noun type from noun number, the patterns of agreement by noun type are broken down for conjunctions in which both of the nouns are singular (Table 4.4). There was only one instance of conjoined singular pronouns, so that category is excluded from the table, and mixed conjunctions (consisting of nouns of different types) are also excluded.

Table 4.4: Noun Type x Verb Agreement, when Both Conjuncts were Singular

Conjunct Type	singular verbs	plural verbs	proportion singulars
animates	0	44	0
collectives	0	13	0
count nouns	24	58	0.29
mass nouns	41	59	0.41
deverbals	87	14	0.86

This table, which includes only singular nouns, shows the same patterns of agreement as were found when noun number and noun type were considered separately.

These results are in line with expectations derived from the animacy hierarchies (Aissen, 1999; Bahloul & Harbert, 1993; Corbett, 2006) that predict higher rates of plural agreement with more animate/agentive subjects and provide corroborating evidence that noun type is a crucial factor in determining verb agreement with conjoined nouns. The experimental tasks in Chapters 5 and 6 are designed to further untangle the factors of animacy, count/mass syntax, and deverbal/simple nouns.

Discussion

Overall, the corpus data paint a tentative picture of how noun type and noun number influence agreement with conjoined subjects in American English. On the whole, conjoined subjects are more likely to take plural agreement than singular agreement, and they elicit plural agreement in approximately 3 out of every 4 sentences. However, there are certain factors that increase the likelihood of singular agreement.

Noun type arises as an important factor. Conjoined pronouns and animate subjects are much more likely to take plural agreement than mass nouns or deverbals, which can be explained along the dimensions of abstractness, animacy, and agency. Another important factor is noun number. Plural nouns reduced the rate of singular agreement, and it appears that linearly proximate plural nouns may elicit more plural agreement than plural nouns in linearly distant positions.

The fact that introducing plural nouns induces more plural agreement provides evidence for the role of lexical plurality in creating plural agreement. This increase in plural agreement accompanying the insertion of a plural noun can fit into any of the major psycholinguistic models discussed in Chapter 3. What is harder to explain is the increase in plural agreement when the closest conjunct is plural. In the Principles-and-Parameters theories of conjoined subjects (as discussed in Chapter 2), which are built around first conjunct agreement with postverbal subjects, the first conjunct should be the more prominent conjunct, but this does not explain why the plural marking on the second conjunct seems to be playing a larger role.

All of the conjunctions evaluated in the corpus task involved preverbal subjects, and one explanation for the proximity effects is a self-monitoring account (see (Hartsuiker & Kolk, 2001)). If the monitor is sensitive to local coherence (Tabor, Galantucci, & Richardson, 2004),

then a higher rate of agreement with the noun linearly proximate to the verb would be expected.

An alternate explanation is an activation-based mechanism (Haskell & MacDonald, 2005).

Activation-based models of language production have described the three tasks that are crucial to fluent speech: preparing to produce the next utterance, producing the current utterance, and suppressing the last utterance (Dell, Schwartz, Martin, Saffran, & Gagnon, 1997). In producing a sentence of the form: Conjunct1-Conjunct2-Verb, the suppression of Conjunct1, which allows Conjunct2 to be produced, also increases the activation of Conjunct2, which would increase its ability to form an agreement relationship with the verb (Haskell & MacDonald, 2005), and thus should lead to more agreement with the linearly proximate noun, but this explanation does not explain the absence of attraction to local singulars and the overall asymmetry between singulars and plurals in agreement attraction. These potential explanations will be discussed in more detail in Chapter 7.

The results generated from the corpus study are these: 1) While conjoined subjects by-and-large take plural agreement, they are not constrained to do so in the same way as ordinary plural subject head nouns. Instead, there is more flexibility in agreement, especially if neither of the conjoined nouns is plural. 2) Plural meaning, as is introduced with conjoined animates (pronouns, humans, animals, and collectives), increases the likelihood of plural agreement. On the other hand, 3) Singular meaning can bias the speaker toward producing singular agreement. This singular construal occurs more often with mass nouns and with deverbal nouns than with conjoined animate nouns.

The ability to use singular agreement with conjoined subjects found in this corpus study reflects the flexibility in agreement with conjoined subjects and the influence of semantics on agreement. The rate of singular agreement with conjoined deverbal nouns was surprisingly high,

and so in order to investigate more fully why the deverbal nouns were likely to co-occur with singular agreement, as well as to investigate agreement with conjoined subjects under experimentally controlled conditions, we created a sentence completion task (Chapter 5) that was aimed at answering how noun type influences subject-verb agreement, crossing the factors of mass/count syntax and deverbal morphology, while controlling variability by using only singular, inanimate nouns in the conjunctions, and eliminating other variables such as modifiers and quantifiers that occurred in the sentences that had been gathered from the World Wide Web. Then, in another set of experiments (Chapter 6), we reintroduced the factor of noun number to test the influence of linear proximity, word order relative to the verb, and noun type with speakers of Lebanese Arabic and English.

CHAPTER 5: ONE AND ONE MAKES SINGULAR AGREEMENT¹⁵

The results from the corpus study (Chapter 4) suggest that agreement with conjoined subjects in English is not uniformly plural and that the flexibility observed in agreement patterns is conditioned by the types of nouns that are conjoined. This chapter reports on two sentence completion tasks that were designed to determine the extent of that noun type effect, eliminating confounding factors of animacy and lexical plurality (which were shown to correlate with plural agreement in Chapter 4) and testing agreement patterns with only singular, inanimate conjoined nouns. There is still a wide range of noun types among inanimate nouns, and this noun type manipulation involved contrasting count nouns (e.g., “the circle and square”), mass nouns (e.g., “the wind and rain”), deverbals (e.g., “the exaggeration and lying”), and collectives (e.g., “the playground and arcade”) in a sentence completion task that was designed to elicit number-agreeing verbs.

Sentence completion tasks such as those pioneered for agreement research (Bock & Miller, 1991) have proven to be useful in uncovering factors that influence subject-verb agreement phenomena in a variety of languages. In this experimental paradigm, participants are presented sentence fragments, called “preambles”, either auditorily or visually, and are asked to repeat the preamble and complete the sentence using the preamble they either saw or heard. These preambles are usually subject noun phrases, both simple (e.g., “The umbrella”) and complex (e.g., “The document from the lawyer about the scandals”), which are designed to elicit sentence completions, involving verbs (1a), pronouns (1b), or adjectives – in languages that have adjective agreement (Examples from Bock, Nicol, & Cutting (1999)) .

1. a) The cast in the soap opera was mediocre.
- b) The cast in the soap opera watched themselves.

¹⁵ Portions of this chapter were presented at the 19th CUNY conference on Human Sentence Processing.

One of the major results of the sentence completion paradigm is that notional number values affect agreement patterns, and subject noun phrases that are notionally plural can take plural agreement, even if the subject head nouns are grammatically singular. For example, if grammatically singular subject noun phrases have distributive interpretations, this increases the rate of plural verb agreement (see (Eberhard, 1999; Humphreys & Bock, 2005; Vigliocco et al., 1995; Vigliocco et al., 1996b), among others). An example of this comes from Humphreys & Bock (2005), which contrasted distributive (2a) and non-distributive preambles (2b) involving collective head nouns. The preambles with distributive interpretations elicited more plural agreement than their non-distributive counterparts.

2. a) The gang on the motorcycles

b) The gang near the motorcycles

While both noun phrases are grammatically singular because their subject head noun, “gang” is singular, a distributive reading is preferred for preamble (2a), highlighting the individual members of the gang by specifying that they are on their motorcycles, and leading to notional plurality. On the other hand (2b) is biased toward a collective interpretation, highlighting the group standing near the motorcycles, and leading to a notionally singular interpretation.

The majority of research on the influence of noun type (and notional number) on agreement has involved complex noun phrases of the form “NP + PP”, but conjoined noun phrases are also prime candidates for viewing the effects of notional number, since they are already grouped, at least to some degree, by the syntax. When subject nouns are conjoined, they share a predicate, which generally indicates that they share the same properties (e.g., “Mary and John are happy.” or are performing the same actions (e.g., “Mary and John are playing croquet”).

The aim of the experiments in this chapter was to assess how often conjoined noun phrase subjects would lead to singular verb agreement, and in particular, whether noun type effects would be observed for conjoined subjects (as they had been with complex NP preambles), with the ultimate goal of understanding the relative contribution of semantics to agreement in the absence of lexically plural nouns. The experimental preambles were composed of conjoined subject noun phrases using the connector “and” (i.e., NP *and* NP) from various noun types (count, mass, collective, deverbal). The purpose of this manipulation was to achieve the greatest possible sensitivity to singular agreement arising from notional singularity. No plural nouns were used in the experimental items, since the corpus study demonstrated that the presence of a plural noun strongly increases the likelihood of plural agreement. Similarly, since animacy was positively correlated with plural agreement in the corpus study, all experimental items were inanimate. This enabled us to cross the factors of deverbal morphology with count/mass syntax to manipulate semantic influences on agreement arising from noun type, deriving five types of experimental preambles: deverbal mass, deverbal count, simple mass, simple count, and collective.

Noun Types and Agreement

There are systematic variations in notional plurality and noun type, as has been demonstrated in comparisons involving mass nouns, collectives, singular and plural count nouns, and pluralia tantum (Humphreys & Bock, 2005; Middleton et al., 2007). Middleton, Bock, & Verkuilen (2007) showed that the divergence between the notional and lexical value of nouns predicts the rate of notional number agreement in a study that compared the rates of agreement attraction for count, mass, and pluralia tantum head nouns (and singular/plural count local

nouns). Their experimental items involved head nouns that were regular singular count nouns (3a), (singular) mass nouns (3b), (plural) pluralia tantum (3c), and plural count nouns (3d).

3. a) The nightgown across from the mannequins
- b) The lingerie across from the mannequins
- c) The pajamas across from the mannequins
- d) The nightgowns across from the mannequins

Noun phrases with mass nouns as heads were rated as more notionally plural than noun phrases with singular count heads, and noun phrases with pluralia tantum heads were rated as more notionally singular than noun phrases with regular plural heads. This difference in the notional and lexical values affected the patterns of agreement, as noun phrases that had divergent lexical and notional number (i.e., with mass nouns and pluralia tantum) showed more verb agreement that diverged from the lexical number of the head nouns than noun phrases in which lexical and notional number were congruent.

With conjoined noun phrases, one major property that leads to unitary interpretation is “coalescence”, by which two things converge into one when put together (cf. Macnamara (1982)). Conjoined nouns (e.g., “drinking and driving”, “heat and humidity”) frequently coalesce, forming a composite whole in which the meaning is distinct from what it would be if the nouns were interpreted separately. Coalescence can occur if the conjoined nouns are semantically related, or if they are within the same conceptual frame (e.g, “house and mailbox”). The types of nouns that were employed in this study, as well as the conditions under which we would be expected to observe coalescence of conjoined nouns will be discussed in turn.

Mass Nouns

Mass nouns generally are described as referring to “substances”, rather than entities, although this description is not without its limitations. (See Middleton et al. (2004) for a discussion of the difficulties in finding a semantic definition for mass nouns.) Typical mass nouns, such as “air”, “oil”, “flour”, or “thunder” are defined grammatically by their ability to exist without determiners (e.g., “Oil is expensive.”) and by their inability to be pluralized (e.g., *“thunders”). Mass nouns don’t tend to refer to countable quantities, and as their boundaries are generally indeterminate (Laycock, 2006; Middleton et al., 2004), conjoined mass nouns should be highly susceptible to notional coalescence. For example, a speaker who is referring to “the wind and rain” is probably not referring to the wind itself and the rain itself, but to the combination of the wind and rain together, which makes it impossible to stay dry, even with an umbrella. Another conjoined noun phrase with mass nouns that demonstrates the tendency toward coalescence is “cream and sugar”, which describes substances that not only occur in the same contexts (e.g., coffee), but which are also physically stirred together and (relatively) homogenized. An internet search reveals that singular agreement with “cream and sugar” is possible, providing results such as:

4. a) “Cream and sugar is added at your request.”
- b) “Cream and sugar is behind you.”
- c) “Cream and sugar is needed to hide the bitter flavor.”

Because of their substance-like nature conjoined mass nouns should be good candidates for coalescence and, to the degree that notional number controls agreement with conjoined subjects, conjoined mass nouns should be expected to elicit singular agreement.

Count Nouns

In contrast to the substance-like referents of mass nouns, count nouns tend to refer to objects, to things that are countable. Count nouns (e.g., “thimble”, “thunderbolt”) are also grammatically differentiated from mass nouns in that they cannot exist in the singular without a determiner (e.g., **“thunderbolt is loud”*), and they can be easily pluralized (e.g., “thimbles”, “thunderbolts”). Concrete count nouns, which often have more determinate boundaries than mass nouns, will tend to reflect co-occurrence rather than coalescence when conjoined. Conjoined noun phrases like: “the tree and flagpole” do not conjure up images of trees functioning as flagpoles, but rather of two objects, a tree, and a flagpole, which may be in close proximity. Coalescence and singular agreement are, therefore, less likely with count nouns than with mass nouns. However, singular agreement with conjoined count nouns *is* possible. If conjoined count nouns take singular agreement, it may be because the juxtaposed nouns create a composite whole, and generally one in which one of the two nouns plays a more prominent role. One frequent conjunction of count nouns is “cup and saucer”, which can also take singular agreement. Cups are placed in saucers, creating a composite unit, with the cup as the prominent element. Internet search results reveal singular agreement with sentences such as:

5. a) “Your musical cup and saucer is porcelain with 22k gold accents.”
- b) “A cup and saucer is not much more than a simple bowl and a shallow plate.”
- c) “This cup and saucer is in very good condition.”

Conjoined count nouns will therefore be expected to elicit singular agreement occasionally, when the two objects form a composite unit that is named by its individual parts, but less often than after conjoined mass nouns.

Collective Nouns

Collective nouns (e.g., “team”) are, for the most part, grammatically singular in American English, although they are often notionally plural (Bock et al., 2006). Syntactically, collectives behave like count nouns, requiring determiners in the singular (e.g., “arsenal is large.”) and allowing pluralization (e.g., “fleets”, “playgrounds”). Semantically, they can have either unitary or distributive readings (Humphreys & Bock, 2005). In the unitary readings, it is the entity of the group that is salient, so the collective noun is notionally singular. In the distributive readings, the individual members of the collective are salient, creating a notionally plural interpretation. If collective nouns coalesce, they will either create a conglomerate, where the members of both groups are highlighted (which is notionally plural), or they coalesce into a large unitary interpretation, as members of both collectives are collected into one major group. Coalescence of collectives may be expected to be more likely than coalescence of singular count nouns because, in the unitary interpretations, the individual members are not salient, and two collectives could “collect” into a larger collective. Internet search results showed a few instances of singular agreement with conjoined collective nouns “Army and Navy”, which are potentially driven by the unitary interpretation of the combined military forces that is being expressed.

6. a) “A standing army and navy is the best security of peace.”
- b) “The army and navy is under the personal control of the monarch.”
- c) “The French Army and Navy is to be demobilized and disarmed.”

Deverbal Nouns

The final type of nouns is one that has not been widely studied in agreement production research, deverbal nouns, or nouns that are derived from verbs. Because of their verbal origins, these nouns largely denote events (e.g., “celebration”) and activities (e.g., “running”), although

they may also refer to objects/substances when they are polysemous with the action (e.g., “insulation” can refer to the insulating material or to the process of insulating, and students might be assigned “a reading” to prepare for class, which refers to what is being read, although “reading” most often refers to the activity itself.)

Deverbal nouns were chosen as a separate group for this analysis because of how they had behaved in the corpus study, and they have long been understood as a unique subclass of the nominal system (Grimshaw, 1990). Deverbals, for the purpose of this experiment, are defined as nouns that are morphologically derived from verbs by the addition of a suffix (e.g., “performance”, “performing”), and they often describe events, activities, or processes. If they have boundaries, they tend to be along the time dimension, rather than having concrete boundaries in space. Syntactically, deverbal nouns can be either of the count or mass variety, often alternating depending on their context. For example, the noun “signing” can be a mass noun if referring to the action of signing without specifying an end goal (e.g., “U.S.G.A. officials banned *the signing of autographs* on the course itself and around the putting green” Source: NYTimes.com, August 7, 2007)¹⁶. However an author can schedule a “book signing”, in which a bounded time is set, and something is accomplished – the author signs the books of those who come into the store¹⁷. The number properties of deverbal nouns are difficult to evaluate, as Bock, Nicol, and Cutting (1999) note, claiming that number is “abstract and often indeterminate” (p. 341) for nouns describing states and events.

¹⁶ Gerunds can be more nominal or verbal in their readings. Verbal readings of gerunds cannot take determiners but can take direct objects (e.g., “baking a cake”). However, most gerunds also can have nominal readings, in which the gerunds behave syntactically as nouns, not verbs. Because all of the experimental items involved determiners, we ensured that all deverbals were behaving syntactically as nouns.

¹⁷ Telicity is the critical distinction between most count and mass readings. Telic events are bounded, and they tend to produce count nouns, while atelic events are unbounded, and they tend to produce mass nouns.

Conjoined deverbal nouns frequently occur in language, some of the common examples being, “shipping and handling”, “eating and drinking”, or “reading and writing”, and it was singular agreement with conjoined deverbal nouns that made the grammar police sit up and take notice, as William Safire did in his New York Times column, “On Language” (7a-b).

7. a) "I think drinking and driving is a really bad thing."
- b) “The manufacture and distribution of cash is by far the Federal Government’s biggest profit-making operation”

For conjoined deverbal nouns, their abstract quality should make them particularly susceptible to coalescence when conjoined, and singular notional interpretation should be able to occur when the two nouns denote one complex event, state, or activity.

Mass Nouns and their Resistance to Pluralization

One additional hypothesis evaluated by this experiment was whether mass nouns themselves have grammatically singular number markings, which makes them incompatible with pluralization (Levelt, 1989), similar to the markedness of the plural feature (Eberhard, 1997). (This is in contrast to the hypothesis that singular nouns are unmarked, or have the default number marking.) The markedness of mass nouns was evaluated by comparing the behavior of conjoined count nouns with conjoined mass nouns, both for the morphologically simple nouns and with their deverbal counterparts. If notional singularity is responsible for the singular agreement with the conjoined deverbal nouns, and if the notional number properties of deverbal count and deverbal mass nouns are similar, the rate of singular agreement for conjoined deverbal count and deverbal mass nouns should be similar. However, if mass nouns are marked with a lexical, singular specification, the conjoined deverbal mass nouns should show a higher rate of singular agreement, compared to the deverbal count nouns. This, in turn, will provide additional

information about whether mass nouns exhibit their resistance to pluralization because of unique lexical specifications/features or because their behavior in non-conjoined settings is due to notional influences (Middleton et al., 2004).

Experiment 1: Constrained Sentence Completion Task

One of the major challenges in experimental psycholinguistics is to develop a task that will provide constrained responses to achieve a good comparison, while preserving the naturalness of the speech and avoiding having participants adopt task-specific strategies. For this task, the goal was to elicit simple sentences with uniformity in verb selection and only one plausible agreement controller. Uniformity in verb selection was needed to avoid widely differing sentence structures (e.g., passives, transitives, intransitives). It was also important to ensure that there was only one logical subject in the sentence. This was achieved by avoiding inchoatives, which describe a change of state (e.g., “The liquid *hardened* into a gel.”) and equatives (e.g., “The poor qualifications of the applicants has become the main obstacle.” (Allerton, 1992)), which describe a relation of equivalence. Both introduce extra noun phrases that can serve as logical subjects (and possibly as controllers of agreement (Allerton, 1992; Haskell & MacDonald, 2005)).

We therefore created a task in which participants produced a copular verb (*is/are*) and specified a location using a simple prepositional phrase. We elicited these sentences by asking participants to complete the sentences by “telling us where things are”. For example, if the preamble was *the bread and butter*, a participant would repeat the preamble and provide a completion with a sentence like: “The bread and butter are on the table.”, or “The bread and butter is on the table”.

To the degree that notional number affects agreement, we should see singular agreement with conjoined subjects, with the rate of singular agreement depending on the ability of the two conjoined nouns to coalesce. Conjunctions involving simple count nouns, with their distinct boundaries, should show the least singular agreement. Collectives should be slightly less resistant to singular agreement because of their ability to form groups over types of items. Conjoined mass nouns should be expected to exhibit some degree of coalescence, as their substance-like properties allow them to be notionally integrated. Deverbal nouns, both mass and count, should show the greatest ability to coalesce, because they lack spatial boundaries and because of the ease of creating complex events. If, however, mass nouns are marked as singulars, there should be more singular agreement with conjoined deverbal mass nouns than with conjoined deverbal count nouns.

Method

Participants

The participants were 64 undergraduates at the University of Illinois, Urbana-Champaign who received a small payment or partial credit toward an introductory psychology course requirement. All were native speakers of American English.

Materials

The materials consisted of simple and complex noun phrases that were designed to elicit full-sentence completions. The experimental preambles were conjoined noun phrases, consisting of a definite determiner, two singular nouns, and the conjunction “and” (i.e., “The NP and NP”). The definite determiner (“the”) was included to create uniformity across items. (Indefinite determiners could not be used, since mass nouns cannot take indefinite determiners, and

presenting bare noun phrases (without determiners) could not be used, since singular count nouns require determiners.)

Out of the 80 experimental preambles, there were equal numbers (sixteen of each) of each of the 5 noun types: simple count, simple mass, deverbal count, deverbal mass, and collective. The simple count/mass and deverbal count/mass were balanced for syllable length, so the average syllable length of the simple mass conjoined subjects equals the simple counts, and the same held for deverbal mass and count nouns. (Because of word length and morphological issues, it was not possible to match across all experimental preambles.) An example preamble from each of the five noun type conditions is shown in Table 5.1, with the full set listed in Appendix A.

Table 5.1: Types of Nouns in Sentence Completion Task

Type of nouns	Example of conjoined noun phrase
Simple Count	“the name and address”
Collectives	“the directory and catalog”
Simple Mass	“the tea and coffee”
Deverbal Count	“the operation and recovery”
Deverbal Mass	“the singing and dancing”

There were also 68 filler preambles consisting of a variety of noun phrases (e.g., singular and plural nouns, mass nouns, complex noun phrases, and conjoined noun phrases involving singular and plural nouns).

All of the experimental and filler preambles were compiled into sixteen lists and were recorded by a female native speaker of English. Each list contained four items from each type:

simple count, simple mass, deverbal count, deverbal mass, and collective. This generated four lists, with one-quarter of the experimental preambles appearing on each list. An additional four lists were generated by flipping the order of each conjunction (e.g., “the milk and cheese” → “the cheese and milk”), to control for idiosyncratic effects of noun ordering (Benor & Levy, 2006). Every list began with the same 12 fillers, and the remaining 56 fillers were interspersed among the experimental items pseudorandomly, with all the experimental items separated by at least two fillers, and no more than two preambles from the same experimental conditions ever occupying neighboring slots for experimental items in the lists. The experimental preambles also occurred in fixed list positions, with noun phrase type held constant across lists 1-8.

The remaining 8 lists (9-16) were generated by flipping Lists 1-8 from top-to-bottom, except the 12 fillers at the beginning of the lists that remained constant across all lists. Each of the experimental lists was presented to a total of 4 participants, each of whom received only one list.

Normative Ratings

Normative ratings for sensibility and imageability were collected¹⁸. The ratings were collected from 80 undergraduates who participated in this study or in other language-related experiments, after the completion of all sentence completion tasks. For both of the ratings, each rater received 8 items of each noun type (40 items total), and all the items were distributed across two lists. An additional two lists were constructed with the conjunctions in their reverse order (e.g., “the milk and cheese” → “the cheese and milk”), thus creating four versions of each normative rating questionnaire. The mean ratings for each noun type are listed in Table 5.2.

¹⁸ We also attempted to collect ratings on notional number, but there were no differences between any of the categories in number ratings (all $F_s < 1$), presumably because the raters were having trouble dealing with number ratings for two nouns, and for both objects and events. More work needs to be done to devise methods of measuring notional number valuations of conjoined noun phrases.

For the sensibility ratings, participants were asked to judge how sensible each of the preambles was, on a scale of 1 (not sensible) to 5 (completely sensible). The mean ratings of the noun types did not differ significantly, except for the deverbal count nouns, which were rated as significantly less sensible than the deverbal mass and simple mass nouns. The 95% Scheffé confidence interval was 0.55, calculated using the mean-square error from a one-way analysis of variance by items that yielded an $F(4,75) = 5.6$. However, as deverbal count nouns did not differ significantly from deverbal mass nouns, the tendency toward singular agreement is not attributable to sensibility.

For the imageability ratings, participants were instructed to rate items on a scale of 1 to 7 based on how easy they were to picture. Example items of low imageability (e.g., “the truth of the matter”) and high imageability (e.g., “the skyscraper in the city”) were given. The mean ratings of the deverbal count and deverbal mass nouns differed significantly from the collective nouns, which were rated as more imageable than the deverbals. As many of the collectives were locations (e.g., “museum and church”, “arcade and playground”), the high ratings for picturability for the collectives may also correspond to notions of concreteness. The 95% Scheffé confidence interval was 1.63, calculated the same way as for the sensibility ratings, using the mean-square error from a one-way analysis of variance by items that yielded an $F(4,75) = 9.2$.

Table 5.2: Normative Ratings for the Items used in Sentence Elicitation Task

Conjunct Type	Sensibility Ratings Scale: 1(not sensible) – 5(completely sensible)	Imageability Ratings Scale: 1(not picturable) – 7(picturable)
simple count	4.2	4.4
simple mass	4.5	4.8
collective	4.3	5.9
deverbal count	3.8	3.3
deverbal mass	4.4	3.8

Procedure

Preambles were recorded and presented auditorily using PsyScope 1.2.5 (Cohen, MacWhinney, Flatt, & Provost, 1993). Participants were seated in front of a Macintosh computer, wearing a head-mounted microphone for voice recording to a digital tape recorder, and they were asked to read the instructions from the computer screen. Participants were instructed to listen to each phrase (preamble), to repeat each phrase exactly as they heard it, and then to fluently complete the sentence, telling us “where things are”, and speaking as quickly as possible. The instructions provided a few example completions (e.g., “on the moon”, “in the clouds”), and provided a full example as well. No practice trials were given (however, fillers at the beginning of each list served as a covert practice phrase). Feedback occurred if participants modified the preamble in a way that changed something other than the number marking on either of the conjoined nouns, if they inserted additional material (besides the verb and the

prepositional phrase), if they used a verb other than the copula, or if they failed to name a location.

The experimenter controlled the presentation of preambles from the prerecorded lists. After each preamble was played, the participant repeated the preamble and completed the sentence. After the sentence was completed, the experimenter advanced to the next trial manually, with a mouse click. Sessions lasted approximately 10 minutes and were recorded on a data recorder for transcription. All participants were tested individually.

Scoring

All responses were transcribed and scored for verb number. Responses were considered valid if participants correctly repeated the preamble, used a number-marked copular verb (is/are/was/were), and followed the verb with a simple prepositional phrase, with no intervening material. All other responses were scored as defective. Responses were excluded if the participant inserted intervening material, generally in the form of a prepositional phrase modifying the subject (e.g., “The name and address *of the applicant* is/are...”). Responses were also excluded if participants produced a verb that was unmarked for number, if there was a misrepetition of the preamble (generally changing the number marking on the head or local noun), or if no completion was provided.

Overall, there were 1,280 responses to the conjoined subjects, 1051 (82%) with valid responses involving verbs that were marked as either singular or plural, with 440 singular (42%) and 611 plural (58%) verbs produced. There were an additional 134 (10%) responses that were marked as singular or plural, but either had false starts, significant pauses before the production of the verb, a verb other than the copula, or insertion of a prepositional phrase modifier. Of these miscellaneous, but number-marked responses, 61 (45%) were singular and 73 (55%) were plural.

In addition, there were 66 (5%) responses that were unmarked for number or in which the participant failed to produce a sentence. There were also 24 (2%) responses in which the preamble was modified, either via the insertion of an extra determiner (e.g., “the name and the address”), through changing the number marking on one of the conjuncts (e.g., “the nameses and address”), or by inserting a head noun and treating the conjunctions as modifiers (e.g., “the front and back entrance”). The final 8 (1%) responses were coded as equatives, in which the participant responded with a predicative noun phrase (e.g., “the garden and orchard are locations”). The proportion of singular verbs produced by category is listed in the Table 5.3.

Table 5.3: Proportion Singular Verbs by Category, Exp. 1

Conjunct type	singular verbs	plural verbs	proportion singulars
simple count	42	177	0.19
simple mass	90	128	0.41
collectives	58	171	0.25
deverbal count	119	71	0.63
deverbal mass	131	64	0.67

Design and Analysis

Each of the 64 participants received four items representing each of the five types of preambles: deverbal count, deverbal mass, simple count, simple mass, and collective. Each of the items was presented to 16 participants (i.e., 8 participants received the items in each conjunct ordering, e.g., “the milk and cheese” and “the cheese and milk”). The dependent variables were the proportion of singular responses for each speaker and item in every noun type condition. In

the primary analysis, separate analyses of variance were performed treating participants and items as random factors. Then, as suggested by Clark (1973), a *minF'* statistic was calculated.

Effects were considered significant if they were at or beyond the level of $p = .05$. In addition, planned pairwise comparisons were used to evaluate predicted differences between the noun types, based on calculations of the 95% confidence intervals for the participants and items analyses separately, using the mean-square error.

Results

Figure 5.1 shows the overall proportions of singular verbs in each of the five noun type conditions (along with the results from Experiment 2 and the results from the singular-singular conjunctions in the corpus study). The proportion of singular verbs was higher with deverbal nouns than with any of the other three noun types. The analysis of variance showed a main effect of noun type ($F_1(4,58) = 44.2, p < 0.001$; $F_2(4,75) = 23.4, p < 0.001$; $minF'(4,129) = 15.3, p < 0.001$).

Conjoined subjects elicited large proportions of singular agreement, especially when the subjects involved deverbal nouns. The relative differences between the deverbal nouns and all other noun types, and between the simple mass nouns and simple count nouns, all exceeded the values of the 95% confidence intervals, which were .04 for participants and .05 for items. Simple mass nouns elicited significantly more singular verbs than simple count nouns and collectives, and deverbal count and mass nouns elicited significantly more singular verbs than any other type. The differences between the deverbal count and deverbal mass nouns were not significant.

Discussion

This paints a highly interesting picture of the behavior of conjoined noun phrase subjects. The results of this experiment demonstrate that, when the morphological and semantic conditions

were right (e.g., when two deverbal, coalescing nouns were conjoined), conjoined NP subjects were more likely to induce singular agreement than they were to induce plural agreement, and conjoined mass nouns were more likely to elicit singular agreement than conjoined count nouns, as was also observed in the corpus study reported in Chapter 4.

However, there was one factor from the constrained sentence completion task that could potentially be skewing the results: Because the participants were telling us ‘where things were’, the two nouns were placed in the same geographical location. For the deverbal nouns, it is possible, then, that coalescence of nouns was being promoted by the two nouns being put in the same space beyond what would normally occur when a speaker is conjoining two nouns (Morgan, 1969). For the deverbal nouns, many of which are events, this could force the complex reading and therefore create a notionally plural event.

Experiment 2: Unconstrained Sentence Completion Task

The goal of Experiment 2 was to replicate Experiment 1, verifying that the relatively high proportions of singular agreement observed in Experiment 1 were not due to the task demands of the experimental design. The concern was that, perhaps by having participants tell us “where things are”, the participants were overwhelmingly biased toward singular construals of the scenes, particularly with the deverbal items, with which they could create complex events. We therefore removed any constraints on sentence completion tasks in Experiment 2, asking participants to complete the sentences as they chose, and we compared the results with those from Experiment 1.

Method

Participants

The participants were 64 undergraduates at the University of Illinois, Urbana-Champaign who received a small payment or partial credit toward an introductory psychology course requirement. All were native speakers of American English, and none had participated in Experiment 1.

Materials

The materials were identical to those used in Experiment 1.

Procedure

The procedure was identical to Experiment 1, with one major modification: Instead of asking participants to tell us “where things are”, participants were instructed to repeat the preamble and complete a full sentence however they chose. Feedback occurred only if participants modified the preamble in a way that changed something other than the number marking on either of the conjoined nouns or if they failed to complete the sentence.

Scoring

All responses were transcribed and scored for verb number. Responses were considered valid if participants correctly repeated the preamble and completed the sentence, using a number-marked verb, with no intervening material in between. All other responses were scored separately. Responses were excluded from the main analysis if the participant inserted intervening material, generally in the form of a prepositional phrase modifying the subject (e.g., “The name and address *of the applicant*”), or if participants produced an equative (e.g., “The name and address are all he needs.”). Responses were also excluded if participants produced a

verb that was unmarked for number, if there was a misrepetition of the preamble (generally changing the number marking on the head or local noun), or if no completion was provided.

Overall, there were 1,280 responses to the conjoined subjects, 647 (51%) with valid responses that were marked as singular or plural, with 287 (44%) singular and 360 (56%) plural verbs produced. Compared to Experiment 1, this was a large increase in the number of unscorable items, primarily due to the increase in verbs that were unmarked for number. There were an additional 234 (18%) responses that were marked as singular or plural, but either had false starts, significant pauses before the production of the verb, insertion of a prepositional phrase modifier (e.g., “the front and back *of the book*”), or involved equatives (e.g., “the front and back are entrances.”). Of these miscellaneous, but number-marked responses, 167 (71%) were singular and 67 (29%) were plural.

In addition, there were 346 (27%) responses that were unmarked for number or in which the participant failed to create a sentence, and 53 (4%) responses in which the preamble was modified, either via the insertion of an extra determiner (e.g., “the name and *the* address”), through changing the number marking on one of the conjuncts (e.g., “the names and address”), or by inserting a head noun and treating the conjunctions as modifiers (e.g., “the front and back *entrance*”). The raw numbers and proportion of singular verbs produced by category for all valid responses is listed in Table 5.4.

Table 5.4: Proportion Singular Verbs by Category, Exp. 2

Conjunct type	singular verbs	plural verbs	proportion singulars
simple count	35	116	0.23
simple mass	56	77	0.42
collectives	56	117	0.32
deverbal count	74	26	0.74
deverbal mass	66	25	0.73

Design and Analysis

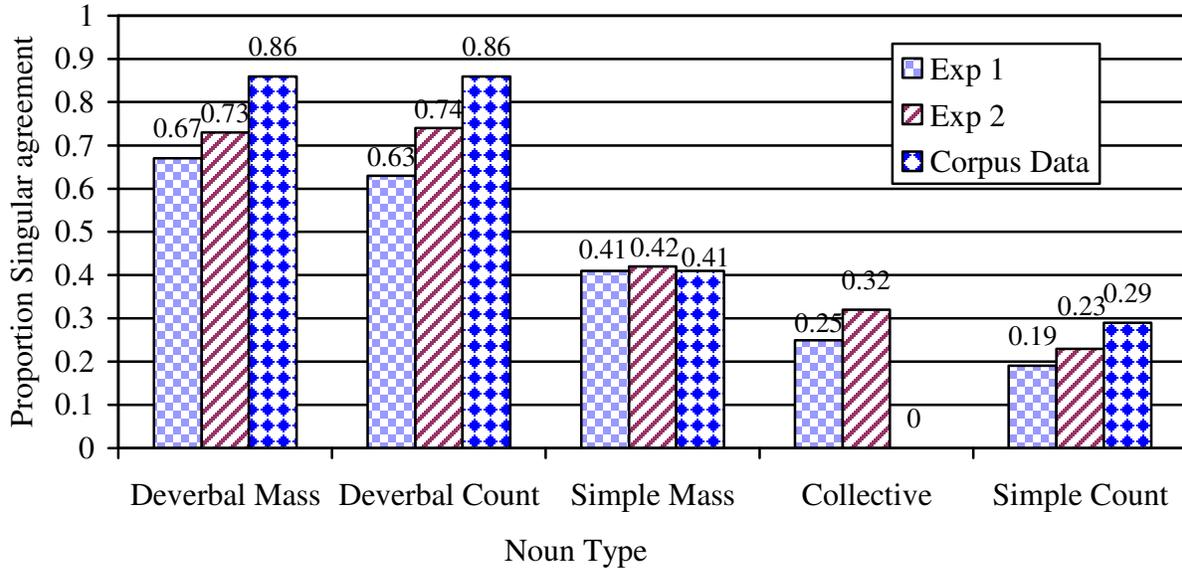
Same as Experiment 1

Results

Figure 5.1 shows the overall proportions of singular verbs in each of the five noun type conditions (along with the results from the Singular-Singular nouns in the corpus study and from Experiment 1)¹⁹. Just as in Experiment 1 and in the corpus study, the proportion of singular verbs was higher with deverbal nouns than with any of the other three noun types. The analysis of variance showed a main effect of noun type ($F_1(4,52) = 16.4, p < 0.001$; $F_2(4,74) = 16.5, p < 0.001$; $minF'(4,122) = 8.2, p < 0.001$). (Because of the number of miscellaneous responses, there were empty cells in both the items and the participants analyses.)

¹⁹ The comparison between the corpus data and the experiments is not exact because the corpus data included animates, while all the nouns used in the experimental tasks were inanimates. The majority of collectives in the corpus were animate, which could explain the lack of singular agreement with collective subjects in the corpus. Similarly, the corpus study did not distinguish between deverbal count and deverbal mass nouns, so the overall rate of singular agreement with singular-singular deverbal nouns is reported for both the deverbal count and deverbal mass categories.

Figure 5.1 Proportion Singular Agreement in Experiments 1 & 2 and with the Singular-Singular Conjunctions from the Corpus



As in Experiment 1, conjoined subjects elicited large proportions of singular agreement, especially when the subjects involved deverbal nouns. The relative differences between the deverbal nouns and all other noun types, and between the simple mass nouns and simple count nouns, all exceeded the values of the 95% confidence intervals, which were .06 for participants and .07 for items. Simple mass nouns elicited significantly more singular verbs than simple count nouns and collectives, and deverbal count and mass nouns elicited significantly more singular verbs than all other noun types. Collectives elicited significantly more singular verbs than simple count nouns but significantly less than any of the of the noun types. The differences between the deverbal count and deverbal mass nouns were not significant by any analysis.

General Discussion

Overall, the results from Experiments 1 and 2 strongly support the role of semantics in the computation of agreement with conjoined subjects. By creating all the experimental items

from inanimate singular nouns, we eliminated some of the main sources of plural agreement (i.e., animacy and lexical plurality) and provided an opportunity for notional influences to affect agreement. The patterns of results obtained from Experiments 1 and 2 are nearly identical, and they also pattern closely with the results from the corpus task, suggesting that these effects are not task-specific but are part of more general properties of language. Both the sentence completion experiments and the corpus data indicate that there is an overall increase in singular agreement with conjoined mass nouns over count nouns but that the effect is not due to special properties of mass nouns nor a lexical singular specification (because deverbal mass and count nouns behaved similarly), but that the abstractness of boundaries and ability to coalesce into complex masses and events creates the notional singularity that induces a rise in singular agreement. Deverbal mass and count nouns showed the highest tendency toward singular agreement, indicating their affinity toward coalescence.

Experiment 2 showed little difference in the tendency toward singular agreement, as compared to Experiment 1, suggesting that the task demands of specifying objects in a particular location were not driving the participants to use more singular agreement.

Role of Lexical Plurality

The rate of singular agreement in this set of experiments was extremely high (between .19-.73 for all “valid” responses in Experiments 1&2). However, lexically plural head nouns have been found to elicit less than 5% singular agreement in English, even for notionally singular nouns (e.g., “pajamas”) (Haskell & Bock, 2003; Middleton et al., 2007). Similarly, the corpus study (Chapter 4) demonstrated that plural agreement was more likely when one of the conjuncts was plural. The corpus study also suggested that the placement of the plural noun influenced the rates of singular agreement, since the lowest rates of singular agreement were observed when the

closest conjunct to the verb was plural. This indicates that conjoined noun phrases are not plural in the same way as lexically plural nouns are and that lexically plural nouns “enforce” plural agreement.

The next set of experiments will explore the role of plural morphology in agreement by manipulating the number marking on the conjuncts. This contrast will compare the influence of plural marking on the closest and furthest conjuncts, as well as the role of word order in agreement by comparing singular-singular, plural-singular, and singular-plural conjunctions in both preverbal and postverbal subject position. In addition, a manipulation of animacy is included to explore the relative impact of notional and lexical plurality on agreement with conjoined subjects.

CHAPTER 6: WORD ORDER AND CLOSEST CONJUNCT AGREEMENT²⁰

The results from the corpus study (Chapter 4) and the sentence completion tasks (Chapter 5) have demonstrated that singular agreement will often occur with conjoined subjects, especially when the nouns are singular, inanimate, and available to become part of a more complex whole, most often as event nouns (deverbals) or as mass nouns that have abstract boundaries. The goal of this next set of experiments was to address how lexical plurality, proximity, and linear word order affect the production of agreement. One additional goal was to explore the nature of closest conjunct agreement by observing how these effects (i.e., lexical plurality, notional plurality, linear proximity, word order) operate in a language which has the option of closest conjunct agreement, namely Lebanese Arabic. A further motivation for using Lebanese Arabic is that it affords the ability to manipulate two predicative agreement targets in the same sentence: Lebanese Arabic exhibits agreement on adjectives as well as verbs, which allows for more precise manipulations of word order, with targets that both precede and follow the subject in the same sentence.

Closest Conjunct Agreement

Closest conjunct agreement occurs when an agreement target forms an agreement relationship with only one of the conjoined nouns (1b), rather than with both conjuncts (1a) & (1c). In the examples below, this is reflected through gender agreement, since singular number agreement is required with postverbal subjects in Modern Standard Arabic. (Examples from Soltan (2006).) “Zayd” is the name of a male, and “Hind” is the name of a female. Gender resolution rules in Arabic would require that, if a masculine and feminine noun are conjoined, the resolved agreement feature would be masculine. In (1a), although the closest conjunct is

²⁰ Portions of this chapter were presented at the 2006 International Language Production Workshop at Northwestern University in Evanston, IL as well as at the 2007 Penn Linguistics Colloquium at the University of Pennsylvania, Philadelphia.

feminine, the verb reflects the resolved masculine gender agreement. In (1b), the closest conjunct is feminine, and the verb exhibits gender agreement with the closest conjunct, in an instance of closest conjunct agreement. With preverbal subjects, full agreement (in gender and number) is required, as reflected in the masculine dual morphology on the verb (1c).

1. a) ʒaʔa Hind-u wa Zayd-un (MSA)

came-3MS Hind-NOM and Zayd-NOM

‘Hind and Zayd came.’

b) ʒaʔa-t Hind-u wa Zayd-un

came-3FS Hind-NOM and Zayd-NOM

‘Hind and Zayd came.’

c) Zayd-un wa Hind-u ʒaʔaa

Zayd-NOM and Hind-NOM came-3M.DU

‘Zayd and Hind came.’

Closest conjunct agreement is often called “first conjunct agreement” because it most frequently occurs in VS word orders, in which the closest conjunct to the verb is the first. Corbett (2006, p.170) compiles an extensive list of languages in which closest conjunct agreement is attested, and this list involves languages from several families (Albanian, Bagwalal, Dzamba, Latin, Marathi, Ndebele, Serbian/Croatian/Bosnian, Slovene, Spanish, and Tsez). Other languages not included in Corbett’s list include Czech (Johannessen, 1996), Finnish (Dalrymple & Nikolaeva, 2006), Hindi (Bhatia, 2007), and Welsh (Harbert & Bahloul, 2002). First conjunct agreement is also occasionally observed in SV word orders, in which agreement relationships are formed with the furthest conjunct, but this pattern of agreement is relatively rare (attested only in

3. a) ?akal-at T-Taalibaat-u
 ate-3FS the-student.FPL-NOM
 'The students ate.'
- b) *?akal-na T-Taalibaat-u
 ate-3FP the-student.FPL-NOM

The ungrammaticality of full agreement in VS orders is unique to Modern Standard Arabic (which, admittedly, is not a natural living language and exists primarily through news media). More often, when reduced agreement is an option allowed by the grammar, full agreement is allowed as well (as in the Arabic dialects), and is positively correlated to animacy (Belnap, 1993). This is similar to the option of full agreement with numerals in Russian when partial agreement is also available (4).

(Data from Corbett, 2006.)

4. a) Voš-l-o pjat' devušek (Russian)
 come.in-PST-N.SG five.NOM girl.PL.GEN
 'Five girls came in.'
- b) Voš-l-i pjat' devušek
 come.in-PST-PL five.NOM girl.PL.GEN
 'Five girls came in.'

As mentioned in Chapter 2, the asymmetries between preverbal and postverbal subjects are prevalent in a wide range of languages, with more agreement morphology realized on verbs that follow their subjects than on verbs that precede their subjects. The nature of the optionality of agreement in VS word orders is important, because it reveals competing influences in the construction of subject-verb agreement.

Linear Proximity

In addition to asymmetries involving preverbal and postverbal subjects, another factor to consider is linear proximity. Several studies have shown that linear proximity *alone* does not determine agreement production and that hierarchical structure is a stronger influence than linear proximity (Bock & Cutting, 1992; Franck et al., 2002; Vigliocco & Nicol, 1998). However, there is evidence from equatives, disjunctions, and conjunctions that linear proximity may play a role in agreement. Equative sentences allow agreement with postverbal noun phrases more readily when the postverbal noun phrases are linearly closer to the verb than the preverbal noun phrases (Allerton, 1992). In these examples (from Allerton, 1992), agreement with the postverbal noun phrase is more readily acceptable for sentences (5a) and (6a) which are directly followed by noun phrases than in (5b) and (6b), where the verbs are directly preceded by the subject noun phrase.

5. a) The poor qualifications of the applicants has/have become the main obstacle.
 b) The applicants' poor qualifications has/have become the main obstacle.
6. a) Among linguists, what seems to matter most is/are the arguments.
 b) For linguists, the most important factor is/are the coherence and logical soundness of the arguments.

Both disjunctions and conjunctions in Slovene (Harrison et al., 2005) have also shown effects of linear proximity in agreement. In this study, participants completed either sentences with disjunctions involving singular and/or dual nouns or sentences with conjunctions involving singular and/or plural nouns. All sentences were of the SV order, and the experimenters found that, with the disjunctions, there were higher rates of dual agreement for singular-dual disjunctions than with dual-singular disjunctions. Similarly, for the conjunctions, there were

higher rates of plural agreement for singular-plural conjunctions than for plural-singular conjunctions, showing that verbs were more likely to agree with number-marked nouns when they were in the linearly proximate position.

Similarly, disjunctions in English show a preference toward agreement with the linearly proximate noun, especially for postverbal subjects (Haskell & MacDonald, 2005). In Haskell & MacDonald's (2005) study, which is detailed in Chapter 3, participants produced sentences involving number-marked verbs with either preverbal (7a) or postverbal subjects (7b).

7. a) "Can you tell me whether the clock(s) or the horse(s) is/are red?"
- b) "Is/are the clock(s) or the horse(s) red?"

With postverbal subjects, participants almost always produced verb agreement consistent with the number marking on the closest noun (95% plurals in the plural-singular condition and 2% plurals in the singular-plural condition), and participants showed a tendency toward agreement with the closest conjunct in with preverbal subjects as well.

Lexical Plurality

The effects of linear proximity are striking in part because of the overall strength of lexical plurality in driving agreement, especially in preverbal subjects. In the corpus study, which involved only preverbal subjects, the existence of a plural noun in either of the conjunct positions drastically lowered the tendency toward singular agreement (40% singular agreement for singular-singular conjunctions, 16% singulars for plural-singular conjunctions, and 1% singulars for singular-plural conjunctions.).

Similarly, for non-conjoined subjects, lexically plural nouns exert a strong ability to control their agreement targets, even when notional number is in conflict with lexical number. This is in contrast to the behavior of singular head nouns, which can agree with plural verbs when the nouns

are notionally plural (e.g., collectives) or when plural interlopers introduce features that cause agreement attraction (Eberhard, 1997; Middleton et al., 2007).

Since plural head nouns are stringent agreement controllers, by introducing a manipulation of plurality into the tasks with conjoined subjects, we will be able to explore the nature of the conjoined noun phrase: Are both nouns equally accessible agreement controllers? And how does this interact with word order and linear proximity? Evidence from postverbal disjunctions in English would suggest that verbs are unaffected by plural markers on postverbal disjuncts in the furthest noun position (Haskell & MacDonald, 2005). Is this result limited to disjunctions, where the notional number and logical subject are ambiguous, or can it also be applied to conjoined subjects, where the nouns should semantically be construed in an additive relationship?

Noun Type/Animacy

Animacy is also predicted to play a role in determining agreement, as animacy hierarchies such as those proposed in Bahloul & Harbert (1993) and Corbett (2006) predict higher rates of plural agreement with more animate subjects, and the data from the corpus study (Chapter 4) support this claim. Animacy is built into agreement typologies for some languages, including Hungarian, which allows singular agreement for conjoined inanimates, while plural agreement is preferred for conjoined animate nouns (Example (8) from Edit Moravcsik, p.c. cited in Corbett (2001), p. 20).

8. a) A könyv és a kommentár megérkezett/*megérkeztek (Hungarian)
ART book and ART commentary arrived.S /arrived.PL

‘The book and the commentary arrived.’

b) John és Jill megérkeztek/megérkezett.

John and Jill arrived.PL /arrived.S

‘John and Jill arrived.’

Outline of Chapter

This chapter will discuss three experiments that investigated the effects of noun type/animacy, noun number, linear proximity, and word order between the subject and the verb in English and Lebanese Arabic. The comparison between English and Lebanese Arabic was intended to examine the relationship between closest conjunct agreement (which occurs in Lebanese Arabic) and the above-mentioned variables, which have been shown to affect agreement in English, with the goal of better understanding how closest conjunct agreement works and how it is related to the processes involved in language production.

Experiment 3 explores the effects of semantics and word order when both conjuncts are singular and when the closest conjuncts are plural in English. Experiment 4, also in English, explores the same factors, except instead of pluralizing the closest conjunct, the number manipulation was on the furthest conjunct. Experiment 5 is a comparison between English and Lebanese Arabic, using the same materials as Experiment 3, to explore the differences in agreement strategies for languages with and without the option of closest conjunct agreement.

Experiment 3: Closest Conjunct Agreement in English

This experiment was designed to explore the issues involving linear word order (of the subject relative to the verb) and noun number for agreement with conjoined subjects. The

experiment also included a manipulation of animacy to gain an understanding of how notional number interacts with these other factors – which are primarily syntactic in nature. The word order manipulation was achieved by employing two tasks, one in which participants produced statements (preverbal subjects), and another in which participants asked questions (postverbal subjects). The noun number manipulation was achieved by presenting participants two versions of a subset of the items, one involving two singular nouns, and the other involving a plural marker on the noun closest to the verb.

To test the roles of word order and noun number, as well as to investigate the role of semantics in agreement with conjoined subjects, we used a set of picture stimuli to elicit sentences with conjoined subjects that were marked for number agreement. Because the stimuli were pictures, rather than abstract event nouns and non-imageable mass nouns, we expected an overall reduction in the rate of singular agreement from what we had observed in Experiments 1 & 2 (Eberhard, 1999). The objects were presented separately on the computer screen (one item on the left, and the other on the right), so coalescence-type interpretations would be dis-preferred, thus lowering the tendency toward singular agreement.

Method

Participants

Forty native speakers of English from the University of Illinois at Urbana-Champaign participated in the experiment for credit in an introductory psychology course.

Materials

The materials consisted of pictures of objects that were meant to elicit simple and conjoined noun phrases used with full-sentence completions. Pictures were gathered from several copyright-free sources, as well as from the International Picture Norming Project (Szekely,

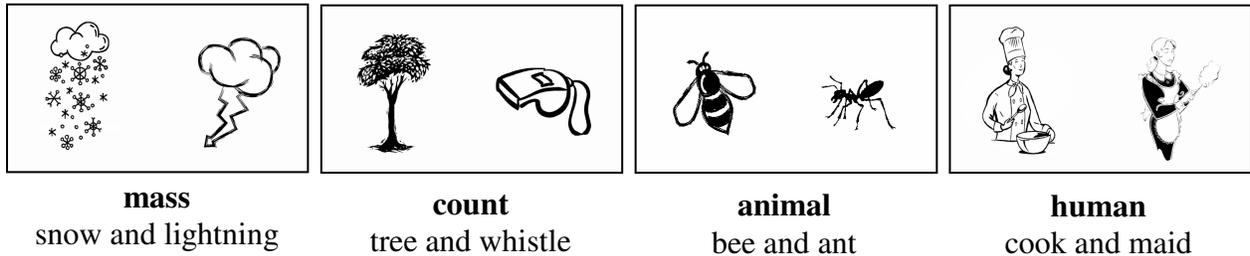
Jacobsen, D'Amico, Devescovi, Andonova, Herron, Lu, Pechmann, Pleh, Wichna, Federmeier, Gerdjikova, Gutierrez, Hung, Hsu, Iyer, Kohnert, Mehotcheva, Orozco-Figueroa, Tzeng, Tzeng, Arrevalo, Vargha, Butler, Buffington, & Bates, 2004). There were two versions of each picture created, one in black-and-white, and another in which the picture was in a primary color (red, blue, or green)²². The black-and-white and color versions of the pictures were otherwise identical, since participants were presented the black-and-white version first, then the color version, and the only thing that “changed” was the color.

Out of the 56 experimental items, which were intended to elicit conjoined noun phrases, there were 8 conjunctions of mass nouns (e.g., *snow and lightning*), 20 conjunctions of count nouns (e.g., *tree and whistle*), 20 conjunctions of animals (e.g., *bee and ant*), and 8 conjunctions of humans (e.g., *cook and maid*). The choice to include unequal numbers for the items in each semantic noun type is due to several reasons: 1) There are very few picturable mass nouns, and even fewer that were mass nouns in both English and Lebanese Arabic. (Several picturable English mass nouns, such as “grass” are plural nouns in Lebanese Arabic.) 2) Lebanese Arabic has a limited number of picturable feminine human nouns, so to achieve a gender balance within each category, we could only choose an equal number of masculine nouns. And 3) This achieved a balance across the number of items that only appeared in the Singular-Singular conditions. (Since 12 of 20 items from each of the categories “count” and “animal” were also modified to achieve a within-subject number manipulation, all of these items appeared twice – once in the singular-singular form and once with the closest conjunct plural, this left 8 additional count and animal conjunctions that did not have a plural counterpart, equal to the number of mass and human conjunctions.) Examples of the semantic types of experimental items are shown in Figure

²² The colors were chosen because they have basic color status (Berlin & Kay, 1969) and because of their morphological similarities in both English and Lebanese Arabic.

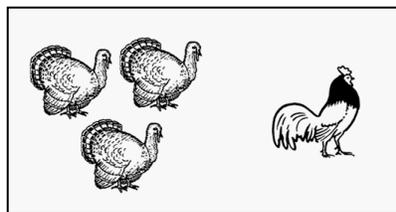
6.1, with all experimental items listed in Appendix B. Each participant received items from four semantic types: mass, count, animal, and human.

Figure 6.1: Types of Conjunctions used in Noun Type Contrast



For the count and animal nouns, there was also a noun number manipulation introduced. Twelve of the 20 items from each of the “count” and “animal” categories were modified to achieve a within-subject number manipulation, with each item appearing once in the singular-singular form, and once when three²³ pictures of one of the nouns was presented, which was intended to elicit a plural noun, as shown in Figure 6.2. The order of the conjuncts was reversed between the singular-singular and the plural-containing forms (e.g., “the rooster and the turkey” → “the turkeys and the rooster”) for each list, so the participants never received the same items in the same order twice.

Figure 6.2: Example of Plural-Singular Item for the Noun Number Contrast



²³ For these experiments, all items designed to elicit plurals had three pictures of the target item. Because of the (largely unused) option of dual agreement in Lebanese Arabic, we avoided presenting just two pictures of any target noun.

Because participants would be creating either preverbal (SV) or postverbal (VS) subjects, there were two versions of each picture. For the preverbal subjects, the plurality of items in the second conjunct position was manipulated. For the participants who would create sentences with postverbal subjects, the plurality of items in the first conjunct position was manipulated. Therefore, there were two versions of each of the plural-containing picture: singular-plural (e.g., “the turkey and roosters”) - for preverbal subjects) and plural-singular (e.g., “the turkeys and rooster” - for postverbal subjects).

In addition to balancing for noun type, the items were also balanced for gender in Lebanese Arabic, which was crossed with the noun type manipulation. Each noun type category had equal numbers of masculine-masculine, masculine-feminine, feminine-masculine, and feminine-feminine preambles, and equal numbers of each gender were also used in the noun number manipulation.

In addition, there were 3 practice items and 84 fillers. The fillers were pictures representing either singular or plural nouns in all four semantic noun types. 28 of the fillers were repeated during the experiment because of the noun number manipulation with the experimental items, in which participants encountered 2 versions of 24 experimental items, to ensure that there was repetition of conjunctions and non-conjoined nouns (this created 112 total fillers). Together, the fillers and experimental items were balanced for gender and number in terms of the verbs they should elicit (if all conjoined noun phrases were to elicit plural verbs). All items, both experimental and filler, were balanced for colors as well, so each participant named equal numbers of items blue, green, and red.

All of the experimental and filler items were compiled into four lists. Experimental items were created with two orderings, varying the placement of the conjuncts. (e.g., “the nail and

ruler”, “the ruler and nail”). Separate lists were needed for the Question (postverbal subject) and Statement (preverbal subject) tasks, because we were testing the effect of the plurality of the closest conjunct, which was the first conjunct for postverbal subjects and the second conjunct for preverbal subjects. 2 lists were used for the statement condition, and 2 were used for the question condition, based on which of the conjuncts was pluralized. Each list began with 12 fillers, and the experimental items and remaining fillers were pseudo-randomly distributed, with no more than 2 experimental items occurring side-by-side, and balanced by quadrant, so that, when the list (after the fillers) was broken up into four equal segments, there were equal numbers of each type of items in each segment. The experimental items and fillers occurred in fixed positions across all four lists, varying only by ordering of conjuncts across the four lists (e.g., “the nail and ruler”, “the ruler and nail”). Color was also assigned pseudo-randomly, so a single color was named no more than three times in a row.

Lists 1 and 2, which were used in the statement task, were identical except that the order of the nouns inside the conjunction was swapped. (e.g., List 1 contained “trash and water”, while List 2 contained “water and trash”.) For the items in which the closest conjunct is plural, the plural noun was always in the closest noun position (the second conjunct in the statement task), while the nouns themselves switched. (e.g., List 1 contained “whistle and trees”, while List 2 contained “tree and whistles”.) Lists 3 and 4, which were used in the question task, were identical to lists 1 and 2, except that the first conjunct was pluralized (e.g., “List 3 had “whistles and tree”, while List 4 had “trees and whistle”). A sample noun number manipulation across lists is shown in Table 6.1.

Table 6.1: Example Manipulation of Noun Number across Lists

List 1	List 2	List 3	List 4
Statement Task	Statement Task	Question Task	Question Task
“Whistle and trees _s ”	“Tree and whistles _s ”	“Whistles _s and tree”	“Trees _s and whistle”
Example statement: “The whistle and (the) trees were blue”		Example question: “Were the whistles and (the) tree blue?”	

Procedure

Participants were seated in front of a Macintosh computer, wearing a head-mounted microphone for voice recording to a digital tape recorder. The experiment was run under computer control using PsyScope 1.2.5 software (Cohen et al., 1993). The experimenter read the instructions to the participants, and three practice items were given. In each trial, participants viewed a picture in black and white for 2 seconds, then the picture changed color – to red, green, or blue for 300 ms. This was followed by a 100 ms blank screen, after which there was a prompt to speak, “!”, which appeared for 500 ms. When participants had completed their response, the experimenter advanced to the next trial with a mouse click. Sessions lasted approximately 15 minutes.

Participants were divided randomly into two equal groups: 20 in the statement task and 20 in the question task. The participants in the statement condition were instructed to “Name the objects and tell us what color they were”, eliciting sentences like “The water and trash were red.” The participants in the question condition were instructed to “Name the objects and ask us what color they were”, eliciting sentences like “Were the water and trash red?” Feedback was given during the practice items if participants used verbs other than the copula (is/are/was/were), if

they gave the color for each of the objects individually (e.g., “the bridge was blue and the boat was blue”), if they used quantifiers or number words (e.g., “both the bridge and the boat were blue”, or “the tree and the three whistles were blue”), or if they otherwise didn’t finish the sentence. Participants were also corrected throughout the session if they began speaking before the prompt (“!”) appeared. Participants were not corrected, however, if they changed the number on the nouns, so as to avoid drawing attention to the noun number.

Scoring

All sentences produced by participants were transcribed and scored. Responses were considered valid if participants used the expected words, formed the sentences in the correct order, and did not add any intervening material. A summary of the scoring criteria is listed in Table 6.2.

Table 6.2: Scoring Criteria for Picture Elicitation Task

Plural	Plural verb, correct sentence structure, with expected nouns and no intervening material
Singular	Singular verb, correct sentence structure, with expected nouns and no intervening material
Miscellaneous	All other responses. Could involve no responses, incomplete responses, non-target lexical items, or responses in which participants named only one of the conjuncts

Overall, there were 3200 responses, 1120 for Singular-Singular conjoined nouns in each of the statement/question tasks, and 480 in each of the singular-plural (statement task) or plural-singular (question task) conditions. In the singular-singular conditions, 847 of the responses

(76%) in the statement task and 835 of the responses (75%) in the question task fell into either the *Singular* or *Plural* category. When the closest conjunct was plural, 362 of the responses (75%) in the statement task and 368 of the responses (77%) in the question task fell into either the *Singular* or *Plural* category.

Design and Analysis

Each of the 40 participants received 80 items in the various experimental conditions. Each participant received singular-singular conjunctions of the following types: 8 of mass nouns, 8 of humans, 20 of animals, and 20 of count nouns. Each of the 20 participants in the statement task also received 12 singular-plural items each for animals and count nouns (24 items total), and each of the 20 participants in the question task received 12 plural-singular items each for animals and count nouns (24 items total). Since the singular-singular items did not vary between the statement and question tasks, each of these items was presented to 40 participants, each of the singular-plural versions of the 24 items in the noun number manipulation was presented to the 20 participants in the statement task, and each of the plural-singular versions of these same items was presented to 20 participants in the question task.

In the primary analysis, two types of analysis of variance were performed. The first ANOVAs compared all the responses for singular-singular conjunctions, looking for the effects of sentence type (word order) and (semantic) noun type, treating participants and items as random factors. The second ANOVAs were performed to examine the effect of noun number, in addition to the factors of sentence type and noun type. In these analyses, the plural-singular/singular-plural items were compared against their singular-singular counterparts, and ANOVAs were performed for the effects of sentence type, noun type, and noun number, treating

participants and items as random factors. Then, as suggested by Clark (1973), *minF'* statistics were calculated for each of these comparisons.

Effects were considered significant if their associated probabilities were less than $p=.05$. In addition, planned pairwise comparisons were used to evaluate predicted differences between the noun types, based on calculations of the 95% confidence intervals for the participants and items analyses separately, using the mean-square error.

Results

Table 6.3 reports the results from Experiment 3, along with the numbers of miscellaneous responses, separated by categories of noun number and sentence type. Table 6.4 separates the results further into categories of noun type.

Table 6.3: Distribution of Responses over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 3

		Singulars	Plurals	Proportion Singulars	Misc.
Singular Nouns	Singular-Singular Preverbal (Statement)	49	798	0.06	273
	Singular-Singular Postverbal (Question)	230	606	0.28	284
Closest Noun Plural	Singular-Plural Preverbal (Statement)	2	360	0.01	118
	Plural-Singular Postverbal (Question)	12	356	0.03	112

Table 6.4: Distribution of Responses over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 3

Conjunct Type	Noun Type	Singulars	Plurals	Proportion Singulars
Singular-Singular Preverbal (Statement)	mass	9	77	0.10
	count	22	308	0.07
	animal	14	303	0.03
	human	4	110	0.04
Singular-Singular Postverbal (Question)	mass	37	49	0.43
	count	97	235	0.29
	animal	66	240	0.22
	human	30	82	0.27
Singular-Plural Preverbal (Statement)	count	1	215	<0.01
	animal	1	225	<0.01
Plural-Singular Postverbal (Question)	count	7	176	0.04
	animal	7	180	0.04

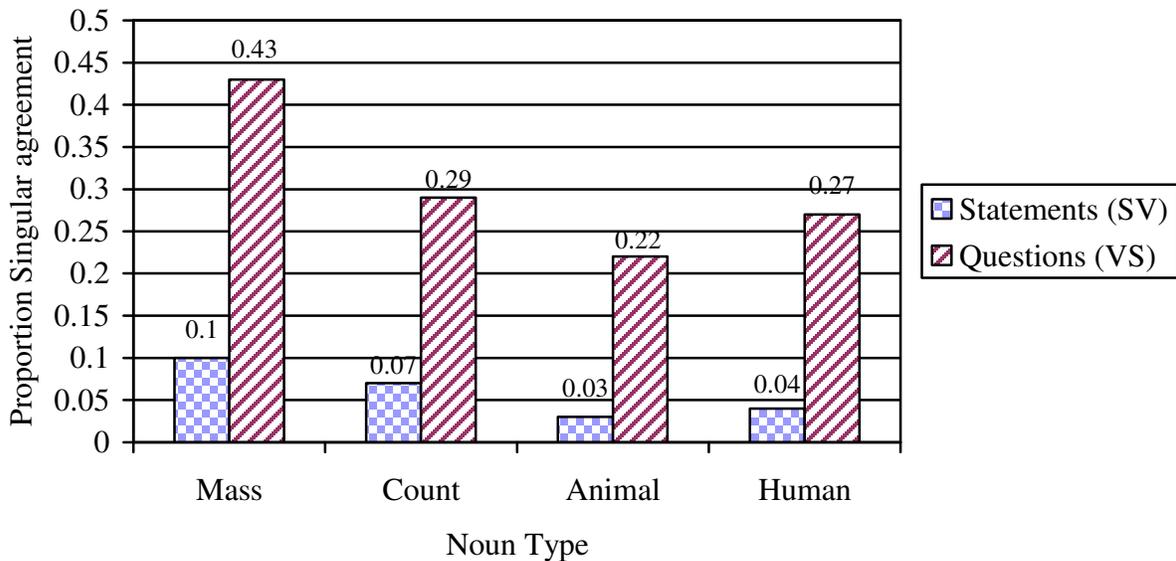
The results for the effects of word order and (semantic) noun type will be reported separately for the comparison in which all the conjoined items were singular and for the noun number manipulation. This singular-singular comparison contrasted all noun types (mass, count, animal, and human) and word order combinations (preverbal and postverbal). The analysis of the effect of the plural conjunct (noun number) was done by contrasting the behavior of the singular-singular conjoined phrases with their counterparts (when one of the two conjuncts was plural) for

animals and count nouns, crossing also the factor of sentence type (word order). The following sections deal with those analyses in turn.

Noun type x Word order (when both conjuncts are singular)

Figure 6.3 shows the overall proportions of singular agreement based on noun type and word order for the conjoined singular nouns.

Figure 6.3 Proportion Singular Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 3



The rate of singular agreement was higher with mass nouns than with the other noun types, and postverbal subjects elicited more singular agreement than preverbal subjects. As shown in Table 6.5, this yielded significant main effects of (semantic) noun type and sentence type (word order), and the interaction between noun type and sentence type was significant in the items analysis, but not in the analysis by participants.

In this comparison, the role of word order and (semantic) noun type are evident, as there was more singular agreement with postverbal subjects than with preverbal subjects, and more

singular verbs with conjunctions involving mass nouns than with conjunctions involving count nouns, animals, and humans. The relative difference between mass nouns and the count nouns and animate nouns (animals and humans) and between the preverbal and postverbal conditions of all noun types exceeded the values of the 95% confidence intervals, which were .03 for participants and .05 for items.

Table 6.5 Analysis of Variance Results, Noun Type x Sentence Type, Exp. 3

(singular conjuncts only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Type	(3,114)	8.4	(3,104)	14.1	(3,209)	5.6
Sentence Type	(1,114)	8.8	(1,104)	203.8	(1,124)	8.4
Noun Type x Sentence Type	(3,114)	1.96* ²⁴	(3,104)	3.76	(3,203)	1.29*

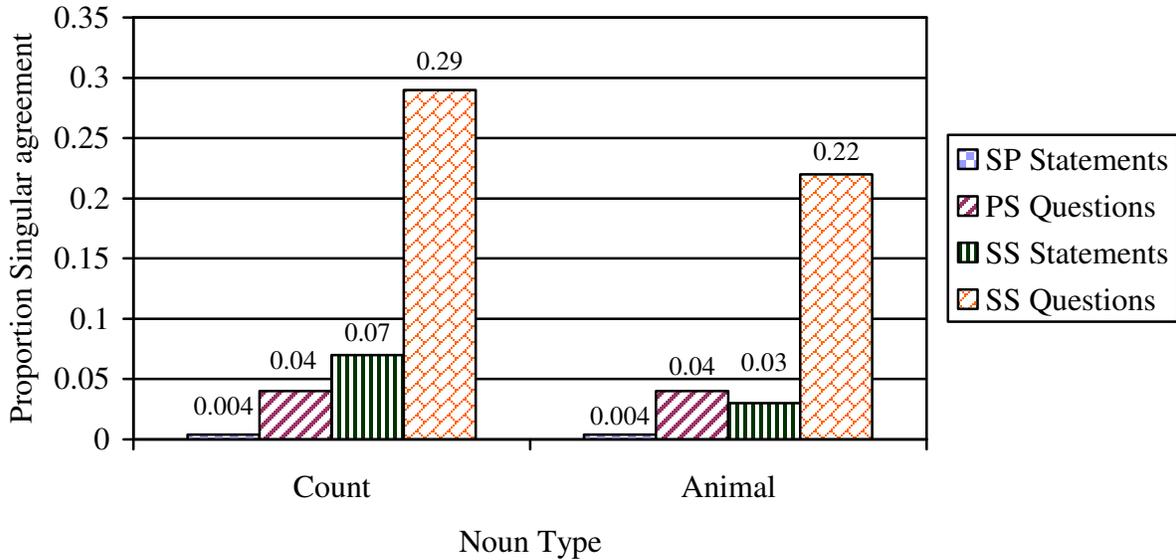
The next comparison for Experiment 3 included the noun number manipulation, which isolated the impact of lexically-specified plurality on agreement with conjoined noun phrases.

Noun Number x Sentence Type x Noun Type (for count nouns and animals)

Figure 6.4 shows the overall proportions of errors based on noun number. The rate of singular agreement was higher when both of the nouns were singular than when the closest noun was plural.

²⁴ “*” indicates that the test statistic failed to reach a significance level of $p < .05$.

Figure 6.4 Proportion Singular Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 3



As shown in Table 6.6, this yielded significant main effects by participants and by items of noun number (singular-singular vs. closest conjunct plural), sentence type (statement vs. question), and of the interaction between sentence type and noun number. Within this number manipulation, the effect of noun type, which compared only (inanimate) count nouns and animals, did not reach the $p = .05$ level of significance.

For the comparison between noun number, word order, and noun type, the highest rates of singular agreement were with postverbal subjects when both of the conjuncts were singular. Introducing a plural marker drastically reduced the rate of singular verb agreement, for both preverbal and postverbal subjects, but in terms of raw numbers, there was still more singular agreement with Plural-Singular Questions (e.g., “Was/Were the turkeys and the rooster red?”) than with Singular-Plural Statements (e.g., “The turkey and the roosters was/were red.”).

Table 6.6 Analysis of Variance Results, Sentence Type x Noun Number x Noun

Type, Exp. 3 (count nouns and animals only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Number	(1,38)	24.1	(1,22)	102.5	(1,53)	19.5
Sentence Type	(1,38)	13.3	(1,22)	71.7	(1,50)	11.2
Noun Type	(1,38)	0.24*	(1,22)	4.1*	(1,42)	0.23*
Noun Number x Sentence Type	(1,38)	9.8	(1,22)	52.0	(1,51)	8.2

The interaction between noun number and sentence type indicates that, relative to their singular-singular counterparts, plural nouns in the postverbal position exerted a stronger pull toward plural agreement, as plural verb agreement was likely for preverbal subjects, even when both conjuncts were singular. The relative difference between the singular-singular questions and between the plural-singular questions exceeded the values of the 95% confidence intervals, which were .03 for participants and .08 for items.

Discussion

This picture description task clearly demonstrated that word order, noun number, and noun phrase semantics are crucially involved in the production of agreement. The rates of singular agreement were much lower than in the sentence completion and corpus tasks, which is likely due to the nature of the task, which relied on pictures flashed on a screen. (For the conjunctions, one conjunct was on the left, while the other was on the right.) This meant that

both conjuncts were highly picturable, with distinct boundaries, in separate locations on the screen, and therefore not very amenable to coalescent interpretations. However, the effect of noun type was still evident, as conjoined mass nouns were more likely to show singular agreement than the conjoined non-coalescing noun types (count nouns, animals, and humans), both for preverbal and postverbal subjects.

On the whole, postverbal conjunctions were more likely to elicit singular agreement than preverbal conjunctions. However, the presence of a plural noun reduced the rate of singular agreement considerably. In this experiment, the rate of singular agreement for preverbal subjects dropped from .06 to .01 when the closest conjunct was plural, and from .28 to .03 for postverbal subjects. To be able to truly distinguish the influences of word order, and noun number, and linear proximity, we also need to look at the effect of plural nouns in the most distant conjunct, which is the manipulation in Experiment 4.

Experiment 4: Furthest Conjunct Agreement in English

Experiment 3 demonstrated that the presence of the plural noun in closest conjunct condition considerably reduced the number of singular verbs produced in both the question and statement tasks. The purpose of this experiment was to replicate the results of Experiment 3 with another set of English speaking participants, looking for effects of noun type, word order, and noun number, except that in the noun type manipulation, plural conjuncts would be in the furthest position, rather than in the closest position (i.e., plural-singular conjunctions for statements and singular-plural conjunctions for questions). If there is a similar reduction in the rate of singular agreement when the most distant conjunct is plural, this rules out a proximity/closest conjunct agreement explanation for the reduction of singular agreement observed in Experiment 3. If, however, there is no reduction in singular agreement when the

most distant conjunct is plural, then proximity remains a viable explanation for the agreement patterns observed in Experiment 3.

Changing the experimental setup between pluralizing the closest conjunct (Experiment 3) and pluralizing the furthest conjunct (for this experiment) was accomplished by exchanging the lists from Experiment 3 between tasks. Lists 1 and 2, in which the right-most conjunct was plural, and which had been used to elicit statements in Experiment 3 (e.g., “The whistle and trees was/were red”), were used instead in the question task in Experiment 4, eliciting responses like, “Was/were the whistle and trees red?”, with the plural marker on the furthest conjunct from the verb. Lists 3 and 4, in which the left-most conjunct was plural, were used in the statement task in Experiment 4, eliciting responses like, “The trees and the whistle was/were red.”

Method

Participants

Forty participants from University of Illinois at Urbana-Champaign who were self-reported monolingual speakers of English participated in the experiment for credit in an introductory psychology course or for monetary compensation (\$7-\$10). None of these speakers had participated in any of the previous experiments.

Materials

The lists were identical to those used in Experiment 3. The only major difference is that, for the question task, participants were given List 1 or 2, and in the statement task, participants were given List 3 or 4. This meant that, in the number manipulation, the furthest conjunct was plural, rather than the closest conjunct (as in Experiment 3).

Procedure

Identical to Experiment 3.

Scoring

All sentences produced by participants were transcribed and scored. Responses were considered valid if participants used the expected words, formed the sentences in the correct order, and did not add any intervening material. Scoring criteria were identical to those used in Experiment 3, as reported in Table 6.2.

Overall, there were 3200 responses, 1120 for Singular-Singular conjoined nouns in each of the statement/question tasks, and 480 in each of the Singular-Plural or Plural-Singular conditions. In the singular-singular conditions, 784 of the responses (70%) in the statement task and 842 of the responses (75%) in the question task fell into either the *Singular* or *Plural* category. When the closest conjunct was plural, 363 of the responses (75%) in the statement task and 405 of the responses (84%) in the question task fell into either the *Singular* or *Plural* category.

Design and Analysis

Identical to Experiment 3.

Results

Table 6.7 reports the rates of singular and plural agreement for the word order and noun number manipulations, along with the numbers of miscellaneous responses for each category.

Table 6.7: Distribution of Responses over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 4

	Singulars	Plurals	Proportion Singulars	Misc.
Singular-Singular Preverbal (Statement)	14	770	0.02	336
Singular-Singular Postverbal (Question)	307	535	0.36	278
Plural-Singular Preverbal (Statement)	7	356	0.02	117
Singular-Plural Postverbal (Question)	123	282	0.30	75

The items were also separated by noun type to check for notional influence on agreement. The proportion of singular agreement by noun type is listed in Table 6.8.

Table 6.8: Distribution of Responses over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 4

Conjunct Type	Noun Type	Singulars	Plurals	Proportion Singulars
Singular-Singular Preverbal (Statement)	mass	6	76	0.07
	count	5	302	0.02
	animal	3	285	0.01
	human	0	107	0
Singular-Singular Postverbal (Question)	mass	41	47	0.47
	count	121	199	0.38
	animal	109	213	0.34
	human	36	66	0.35

Table 6.8, Continued...

Plural-Singular	count	5	182	0.03
Preverbal (Statement)	animal	2	174	0.01
Singular-Plural	count	62	139	0.31
Postverbal (Question)	animal	61	143	0.30

Just as with Experiment 3, the results for the effects of word order and (semantic) noun type will be reported separately for the comparison just involving the singular items and for the noun number manipulation.

Noun type x Sentence Type (when both conjuncts are singular)

As shown in Table 6.9, this yielded a significant main effect of sentence type, but the main effect of noun type was only significant by participants, and the interaction between noun type and sentence type were not significant in any of the analyses (all $F_s < 1.25$).

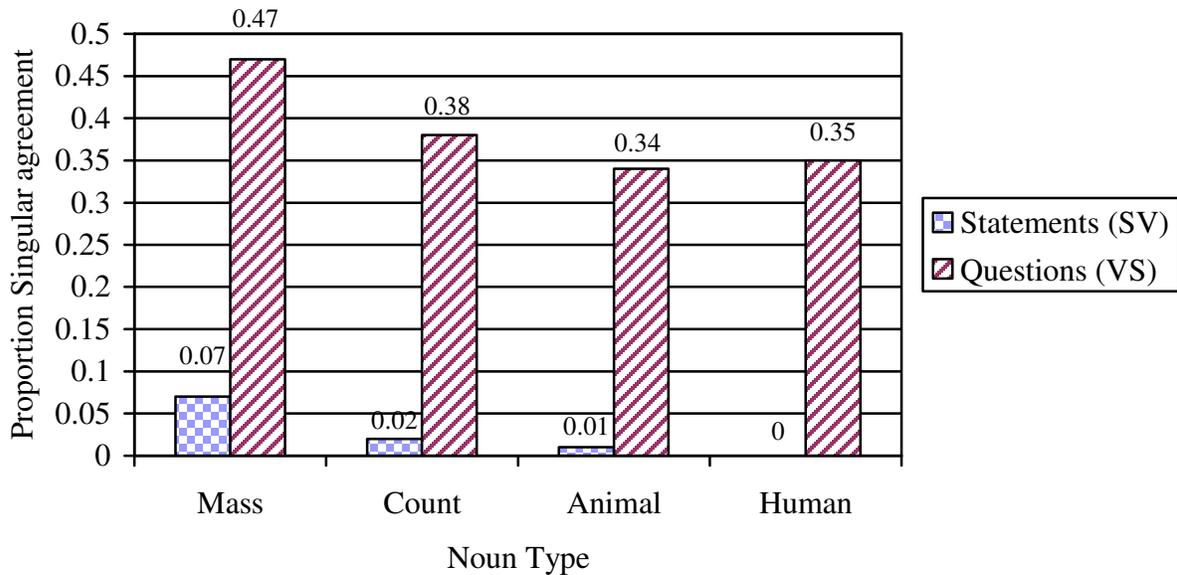
Table 6.9 Analysis of Variance Results, Noun Type x Sentence Type, Exp. 4

(singular conjuncts only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Type	(3,114)	10.1	(3,104)	1.5*	(3,134)	1.3*
Sentence Type	(1,114)	17.0	(1,104)	194.9	(1,134)	15.6
Noun Type x Sentence Type	(3,114)	1.24*	(3,104)	0.54*	(3,183)	0.77*

Figure 6.5 shows the overall proportions of singular verb agreement in Experiment 4 by noun type and word order for the conjoined singular nouns.

Figure 6.5 Proportion Singular Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 4



In this comparison, the main effect of word order is clearly driving the patterns of agreement, with proportions of singular agreement between .34-.47 with postverbal conjoined subjects and only between 0-.07 with preverbal conjoined subjects. The relative difference between the preverbal and postverbal conditions of all noun types and the relative difference between mass nouns and the other noun types exceeded the values of the 95% confidence intervals, which were .03 for participants and .06 for items, providing further support for the results from Experiment 3, and showing that the position of the subject relative to the verb has a massive impact on agreement patterns. All results are in the same direction as Experiment 3. Although the effect of noun type was weaker in Experiment 4, the ability of conjoined mass nouns to elicit singular agreement more often than the other categories remained constant.

Noun Number x Sentence Type x Noun Type (for count nouns and animals)

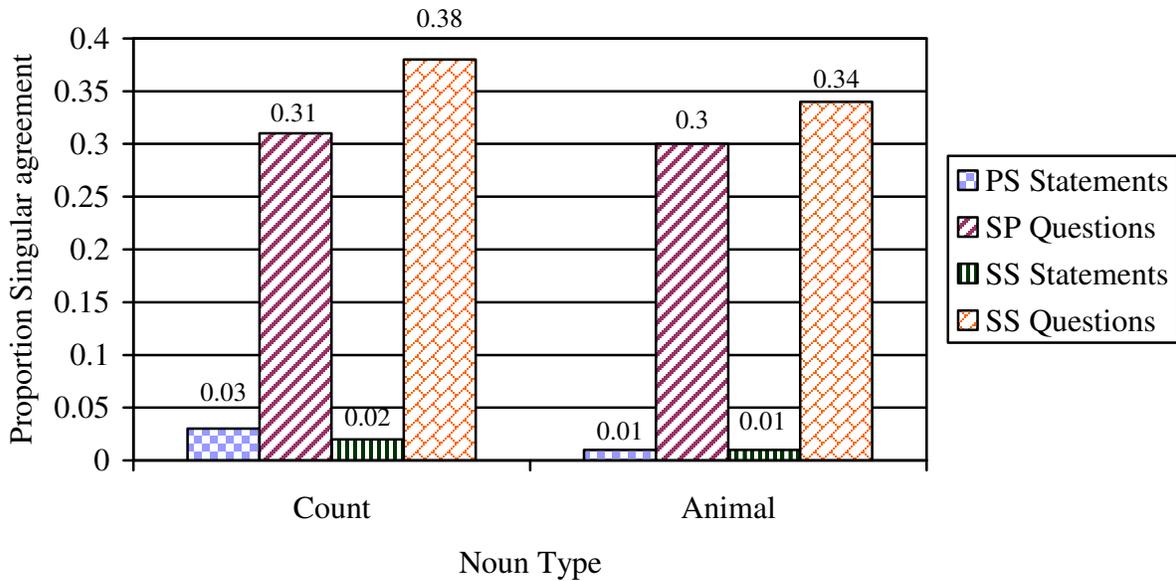
The main difference between Experiments 3 and 4 is evident in the noun number manipulation. As shown in Table 6.10, there was a significant main effect of sentence type (questions vs. statements), as in Experiment 3. However, the effect of noun number was significant only by items, and there is no effect of noun type, although this comparison only involved animals and count nouns. Similarly, there was no interaction between noun number and sentence type.

Table 6.10 Analysis of Variance Results, Sentence Type x Noun Number x Noun Type, Exp. 4 (count nouns and animals only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Number	(1,38)	0.7*	(1,22)	7.9	(1,44)	0.6*
Sentence Type	(1,38)	18.1	(1,22)	203.5	(1,44)	16.6
Noun Type	(1,38)	0.1*	(1,22)	3.6*	(1,40)	0.1*
Noun Number x Sentence Type	(1,38)	0.2*	(1,22)	2.2*	(1,45)	0.2*

Figure 6.6 shows the overall proportion of singular agreement based on noun number and word order. The effect of the plural (most distant) conjunct is much less than the effect of closest conjunct (Experiment 3).

Figure 6.6 Proportion Singular Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 4



The main difference between the results for noun number in Experiment 3 and 4 is visible in the rate of singular agreement with postverbal conjoined Singular-Plural conjunctions (.30, compared to .36 when both conjuncts were singular). The relative difference between the SS statements and SS questions exceeded the values of the 95% confidence intervals, which were .04 for both participants and items. The rate of singular agreement with Singular-Singular preverbal subjects was already significantly lower than either of the postverbal conditions (.01), so the introduction of a plural noun in the preverbal conjoined subjects did not significantly change the agreement patterns.

Discussion

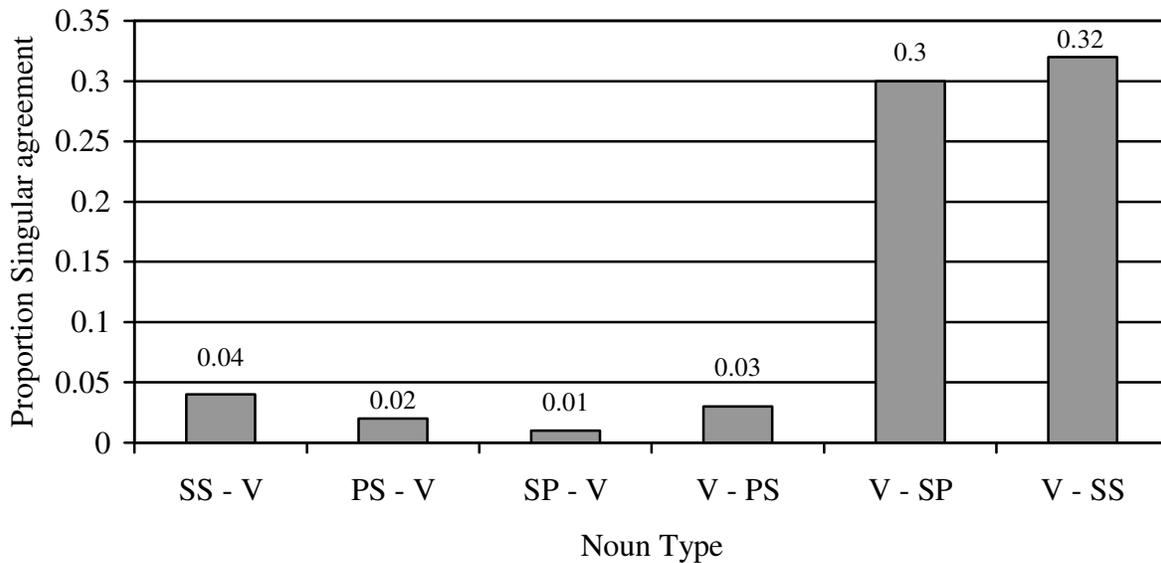
This study replicated the word order effect, and showed that, at least for postverbal subjects, plural conjuncts that are not linearly proximate to the verb do not significantly reduce the rate of singular agreement.

Since Experiment 4 was a manipulation of noun number, differing from Experiment 3 only in the placement of the plural nouns within the conjunction, the results should be analyzed in parallel. Overall, the patterns of results from both experiments are similar for the singular-singular conditions. For both experiments, preverbal subjects elicited low rates of singular agreement for all combinations of noun number. The main differences emerged with postverbal subjects: Plural nouns in the closest conjunct position (Experiment 3) drastically reduced the rate of singular agreement, while there was a much smaller reduction in singular agreement with nouns in the furthest conjunct position (Experiment 4).

The main finding of Experiment 4 is that plural nouns that are not linearly proximate to the verb have little ability to produce plural agreement, especially with postverbal subjects. That preverbal subjects show a much stronger pattern of plural agreement than postverbal subjects demonstrates that word order of the subject relative to the verb is a contributing factor as well.

Figure 6.7 depicts the rate of singular agreement, based on noun number and word order (sentence type) from Experiments 3 and 4, collapsing across noun type. The labels under the graphs indicate noun number and subject placement relative to the verb. (SS - V stands for Singular-Singular + Verb, or conjoined singular preverbal subjects. V - PS stands for Verb + Plural-Singular, or postverbal conjoined subjects in which the closest conjunct is plural.)

Figure 6.7 Proportion Singular Agreement by Word Order and Number Marking on Conjuncts, Experiments 3 & 4



Since proximity has proven to be a significant factor for English agreement with postverbal conjoined subjects, the next logical question that follows is how it compares to closest conjunct agreement. To address this question, we conducted a study using the materials and procedures from Experiment 3 in Lebanese Arabic and with an English-speaking control group, which is reported in Experiment 5.

Experiment 5: Closest Conjunct Agreement in Lebanese Arabic and English

Experiments 3 and 4 looked at the overall rates of plural agreement for English speakers when both conjuncts were singular and when the closest and/or furthest conjuncts were plural. Experiment 5 was intended to explore the root cause of the word order effects that had been observed in Experiments 3 and 4, by contrasting English with a language that has the option of closest conjunct agreement, Lebanese Arabic.

Both Experiments 3 and 4 demonstrated that, for English speakers, full (plural) agreement was more common when conjoined subjects precede verbs than when they follow

verbs. Similarly, the addition of a plural conjunct decreased the rate of singular agreement, and this effect was greater when the plural noun was situated next to the verb. The main question that emerges, then, is what the source is of these proximity and linear effects in English? Is this simply a processing phenomenon, or does it reflect an underlying syntactic difference between preverbal and postverbal subjects? In English, does the singular agreement that appears with postverbal subjects reflect first conjunct agreement, or is it simply a lack of agreement because of other mechanisms? And ultimately – what can this tell us about the nature of the language production mechanism and closest conjunct agreement?

Lebanese Arabic

While many of the Modern Arabic dialects have the option of first conjunct agreement, Lebanese Arabic was chosen for this experiment because Lebanese Arabic speakers often use full agreement with postverbal subjects. (Aoun et al., 1994, footnote 14). Full agreement is required for preverbal subjects, but for postverbal conjoined subjects, first conjunct agreement is allowed, as long as the sentence does not contain any collective predicates or other plural-inducing Number Sensitive Items (e.g., “together”, “both”). Lebanese Arabic also has agreeing adjectives, so when participants specified the colors (red, green, or blue), they were also producing another agreement target that was marked with gender and number information.

Since Lebanese Arabic shows gender agreement, this provides an additional heuristic for diagnosing agreement phenomena, since it is possible to distinguish between singular verbs that emerge as a result of closest conjunct agreement and those that are due to default agreement, or “lack of agreement”. For example, if a postverbal subject is feminine-masculine in its gender composition (e.g., “the girl and the boy” *elbint wel ssabi*) and the verb shows feminine-singular agreement, it is clear that the verb is forming an agreement relationship with the closest conjunct.

If, however, the verb shows masculine singular agreement, then the singular agreement that arises is from a different source: One possibility is that the subject is notionally singular, so while the gender features from the two nouns have resolved their gender values to obtain masculine agreement, the notional number properties mark the verb as singular. On the other hand, it is also possible that the verb is showing default agreement and never established an agreement relationship with the conjoined subject, thus resulting in the (default) masculine singular agreement.

It is generally assumed that the default word order in Arabic is VS (Mohammad, 2000), although many of the dialects show a preference toward SV orders. Since word order is variable in Lebanese Arabic, participants had to be specifically instructed to use the word orders they were given, and they were told in the preverbal subject condition that they were “telling” us what something was, but that they were “asking” us in the postverbal subject condition. The position of the agreeing adjective was held constant across both groups to allow subjects to linearly intervene between two targets in the postverbal subject condition. Specifically, for preverbal subjects, the word order was Subject + Verb + Adjective, and for postverbal subjects, the word order was Verb + Subject + Adjective, which provided a unique opportunity to look for word order effects in agreement production, contrasting two targets that differed in their word order (relative to the subject) in the same sentence.

Method

Participants

Eight native speakers of Lebanese Arabic and twelve monolingual English speakers who were students at the University of Illinois at Urbana-Champaign participated in the experiment for monetary compensation. The majority of the Lebanese Arabic speakers were graduate

students, so the English speakers who were recruited were all graduate students as well, and they also had similar areas of study as the Lebanese Arabic speakers. This was achieved by advertising in departments in which we had found the Lebanese Arabic speakers. Participants were paid \$10 for each of the four times they participated in the experiment, plus a cash completion bonus.

Materials

The lists were identical to those used in Experiments 3. During the original experimental design, all items had been balanced for gender, as well as for number. (The lists that were used in all experiments had been developed with Lebanese Arabic in mind.) Gender was crossed within participant, so each participant received equal numbers of masculine-masculine, masculine-feminine, feminine-masculine, and feminine-feminine conjunctions, both in the singular-singular condition and in the number manipulation. Gender was balanced within each noun type as well (the gender balance was achieved for each of the noun types: mass, count, animal, human). Gender and number balance were also achieved for the full lists, including the filler items.

Procedure

Participants completed four sessions, each no less than one week apart. The lists (and tasks) were given in differing orders, based on a Latin Square design. Each participant completed two lists using the statement task and two lists using the question task. Because there was such a small participant pool, participants only received lists in which the closest conjuncts were pluralized to achieve more statistical power in the analysis. Each experimental session lasted approximately 20 minutes.

The Lebanese participants also completed language background questionnaires at the end of the first session and a “grammaticality preference task” after the final session that involved

pre- and postverbal subjects with both conjoined and regular subjects to ensure that the results would extend beyond the specific types of sentences used in the experiment.

Participants were given instructions orally in their native languages. For the Lebanese participants, instructions were given in Lebanese Arabic. Participants were instructed to speak in the dialectal variety, rather than Standard Arabic, and the experimenter was careful to use only Lebanese Arabic as well. To encourage usage of the Lebanese dialect, which is a primarily spoken variety, rather than Modern Standard Arabic (a primarily written variety), the consent form was read to participants orally, and participants responded with their oral consent. Also, since Lebanese Arabic is a right-to-left language, we specifically instructed participants to name the objects from left-to-right. Since the participants were all fluent English readers and comfortable with reading from left-to-right, this was not a difficult task.

Scoring

All sentences produced by participants were transcribed and scored. Responses were considered valid if participants used the expected lexical items, formed the sentences in the correct order, and did not add any intervening material. For the English-speaking participants, scoring criteria were identical to those used in Experiments 3 & 4, as reported in Table 6.2. For the Lebanese speakers, additional scores were needed: Verbs and adjectives were both marked with number information, and the singular verbs and adjectives were marked with gender information as well. The scoring for English speakers will be reported first.

English Speakers

Overall, there were 3840 responses, 1344 for Singular-Singular conjoined nouns in each of the statement/question tasks, and 576 in each of the Singular-Plural or Plural-Singular conditions. In the singular-singular conditions, 1031 of the responses (77%) in the statement task

and 1054 of the responses (78%) in the question task fell into either the *Singular* or *Plural* category. When the closest conjunct was plural, 434 of the responses (75%) in the statement task and 442 of the responses (77%) in the question task fell into either the *Singular* or *Plural* category.

Lebanese Speakers

Overall, there were 2560 responses that were collected across the four sessions, 896 for Singular-Singular conjoined nouns in each of the statement/question tasks, and 384 in each of the Singular-Plural or Plural-Singular conditions. Because verb number, adjective number, and verb gender were all measured, the breakdown of responses will be presented by each variable in the results section.

Design and Analysis

Each of the 8 Lebanese-speaking participants and the 12 English-speaking participants participated in four sessions, during which they received one version of each of the 80 experimental items in each session. Like Experiments 3 & 4, each received singular-singular conjunctions of the following types: mass nouns (8), humans (8), count nouns (20), and animals (20). Each of these noun types was equally divided among gender conditions, so each participant received equal numbers of each gender combination (masculine-masculine, masculine-feminine, feminine-masculine, feminine-feminine) in each semantic noun type. The singular-singular items only varied in ordering of conjuncts (e.g., “N₁ and N₂” → “N₂ and N₁”) between lists. As in Experiment 3, during the statement tasks, participants received an additional 12 singular-plural items each for animals and count noun. During the question tasks, participants received the plural-singular versions of these items.

For the English speakers, the analyses of variance were performed, just as in Experiments 3 & 4. For the Lebanese speakers, these same analyses were also performed, as well as an additional analysis of variance to examine the effect of sentence type (word order) and (semantic) noun type on adjective number, treating participants and items as random factors. As suggested by Clark (1973), *minF'* statistics were calculated for each of these comparisons.

Effects were considered significant if their associated probabilities were at or below a level of $p=.05$. In addition, planned pairwise comparisons were used to evaluate predicted differences between the noun types, based on calculations of the 95% confidence intervals for the participants and items analyses separately, using the mean-square error.

Results

The results for the English and Lebanese speakers will be reported separately, beginning with the English speakers.

English Speakers

Table 6.11 lists the proportion of singular verbs by noun number and word order, as well as the numbers of the miscellaneous responses in each category.

Table 6.11: Distribution of Responses over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 5 – English Speakers

Conjunct Type	Singular	Plural	Proportion Singulars	Misc.
Singular-Singular Preverbal (Statement)	7	1024	0.01	313
Singular-Singular Postverbal (Question)	193	861	0.18	290
Singular-Plural Preverbal (Statement)	0	434	0	142
Plural-Singular Postverbal (Question)	8	434	0.02	134

The responses were also separated by noun type to check for notional influences on agreement. The relative proportions of singular agreement by noun type are listed in Table 6.12.

Table 6.12: Distribution of Responses over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 5 – English Speakers

Conjunct Type	Noun Type	Singular	Plural	Proportion Singulars
Singular-Singular Preverbal (Statement)	mass	1	106	.01
	count	4	381	.01
	animal	2	396	.01
	human	0	141	0
Singular-Singular Postverbal (Question)	mass	28	85	0.25
	count	72	316	0.19
	animal	71	333	0.18
	human	22	127	0.15
Singular-Plural Preverbal (Statement)	count	0	232	0
	animal	0	202	0
Plural-Singular Postverbal (Question)	count	6	193	0.03
	animal	2	240	0.01

There were two comparisons for the English speakers, just as in Experiment 3. The first comparison involved all the conjoined singular nouns, contrasting effects of noun type (mass, count, animal, and human) and sentence type (statement vs. question) on verb agreement. The

second comparison involved pluralizing the closest conjunct for animal and count nouns, contrasting the factors of noun number with sentence type and noun type.

Noun type x Sentence Type (when both conjuncts are singular)

As shown in Table 6.13, the effect of sentence type is significant, but the effect of noun type and the interaction between sentence type and noun type are significant only in the items analysis, and not in the analysis by participants.

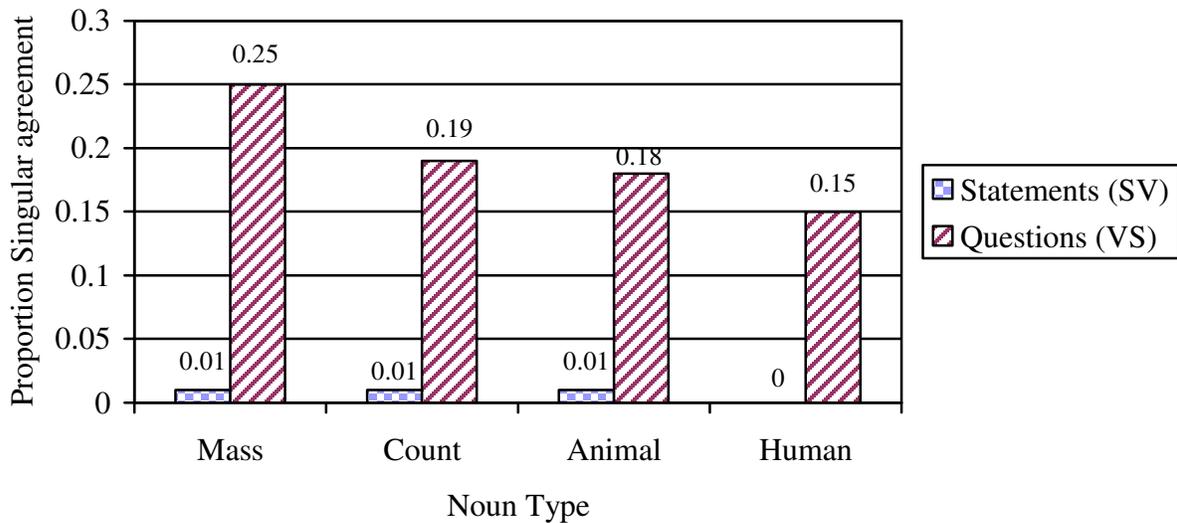
Table 6.13 Analysis of Variance Results, Noun Type x Sentence Type, Exp. 5

English Speakers (singular conjuncts only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Type	(3,33)	2.5*	(3,51)	3.8	(3,71)	1.5*
Sentence Type	(1,11)	5.1	(1,51)	205.9	(1,12)	5.0
Noun Type x Sentence Type	(3,33)	2.2*	(3,51)	3.3	(3,71)	1.3*

Figure 6.8 shows the overall proportions of singular agreement based on noun type and sentence type for conjoined singular nouns.

Figure 6.8 Proportion Singular Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 5 - English Speakers



In this comparison, there was almost no singular agreement for preverbal subjects in any of the noun types. The relative difference between postverbal mass nouns and count and animate nouns (animals and humans), and between the preverbal and postverbal conditions of all noun types, exceeded the values of the 95% confidence intervals, which were .02 for participants and .03 for items. The position of the subject relative to the verb had a strong impact on agreement patterns, and, although the effect of noun type wasn't significant, the patterns of noun type were consistent with those obtained in Experiments 3 & 4, at least for postverbal subjects. This was important for verifying that the within-subject design used with the Lebanese participants would not create strikingly different patterns of results than were observed with Experiments 3 & 4, in which participants only completed one list.

The next comparison for Experiment 5 included the noun number manipulation for the English-speaking participants, which isolated the impact of lexically-specified plurality on agreement with conjoined noun phrases.

Noun Number x Sentence Type x Noun Type (for count nouns and animals) – English

Speakers

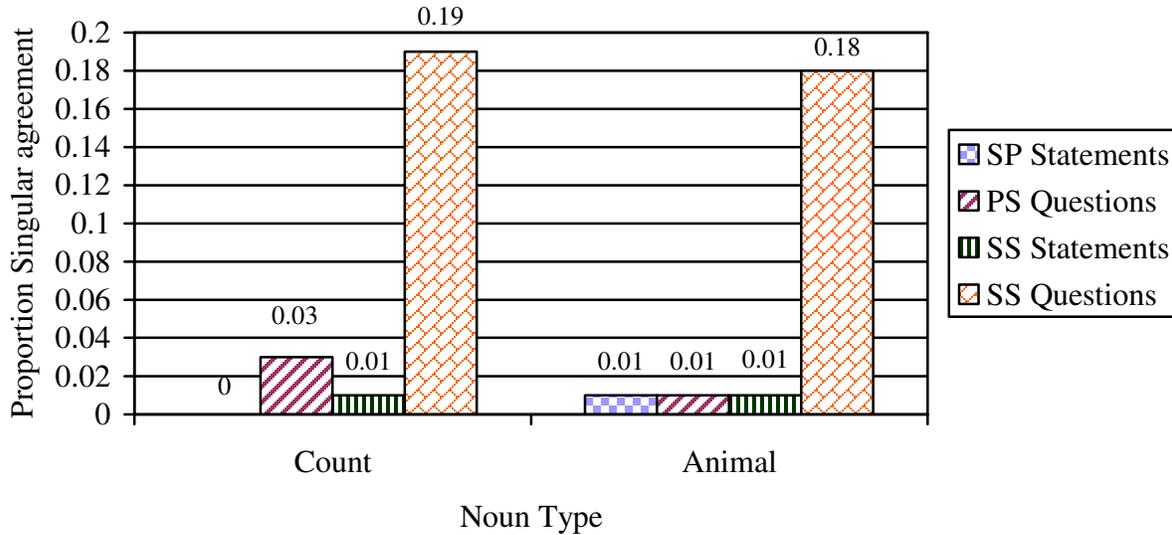
As shown in Table 6.14, there were significant effects of noun number and sentence type. The main effect of noun type was significant only in the items analysis, and interaction between noun number and sentence type was also significant in an items analysis, but only marginal ($p=.07$) in the analysis by participants.

Table 6.14 Analysis of Variance Results, Sentence Type x Noun Number x Noun Type, Exp. 5 – English Speakers (count nouns and animals only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Number	(1,11)	7.2	(1,22)	96.5	(1,13)	6.7
Sentence Type	(1,11)	5.0	(1,22)	99.1	(1,12)	4.8
Noun Type	(1,11)	3.2*	(1,22)	6.4	(1,22)	2.1*
Noun Number x Sentence Type	(1,11)	4.1*	(1,22)	68.3	(1,12)	3.9*

Figure 6.9 shows the overall proportions of singular agreement based on noun type, sentence type, and noun number. As in Experiment 3, the rate of singular agreement was higher when both of the nouns were singular than when the closest noun was plural.

Figure 6.9 Proportion Singular Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 5 - English Speakers



As with Experiment 3, the English speakers showed strong patterns of plural agreement for preverbal subjects. The highest rates of singular agreement were with postverbal conjoined singular nouns, and introducing a plural marker significantly reduced the rate of singular agreement. The relative difference between the singular-singular questions and between the plural-singular questions exceeded the values of the 95% confidence intervals, which were .03 for participants and .02 for items, showing that the introduction of a plural lexical item in the closest conjunct position strongly reduced the rate of singular agreement for agreement with conjoined subjects. As the patterns of agreement were similar for English speakers in Experiments 3 & 5 (although the undergraduates did show more of a willingness to produce singular agreement with conjoined subjects, suggesting formality/register may play a role), the next step is to compare the English data to a language which is known to exhibit closest conjunct agreement, Lebanese Arabic.

Lebanese Arabic Speakers

Verb Number

In the singular-singular conditions, 630 of the verbs (71%) in the statement task and 696 of the verbs (78%) in the question task fell into either the *Singular* or *Plural* category. When the closest conjunct was plural, 255 of the verbs (66%) in the statement task and 239 of the verbs (62%) in the question task fell into either the *Singular* or *Plural* category. The scoring results for verb number, adjective number, and the breakdown of gender agreement will be presented in turn. Table 6.15 lists the proportion of singular verbs by noun number and word order.

Table 6.15: Distribution of Responses for Verb Number over Scoring Categories for Noun Number and Sentence Type Manipulation, Exp. 5 – Lebanese Speakers

Conjunct Type	Singular Verbs	Plural Verbs	Proportion Singulars	Misc.
Singular-Singular Preverbal (Statement)	7	631	0.01	258
Singular-Singular Postverbal (Question)	453	243	0.65	200
Singular-Plural Preverbal (Statement)	1	254	<0.01	129
Plural-Singular Postverbal (Question)	25	214	0.10	145

The items were also separated by noun type to check for influences of notional number on agreement. The proportions of singular agreement on verbs by noun type and conjunct type are listed in Table 6.16.

Table 6.16: Distribution of Responses for Verb Number over Scoring Categories for Sentence Type, Noun Number, and Semantic Noun Type Manipulation, Exp. 5 – Lebanese Speakers

Conjunct Type	Noun Type	Singular Verbs	Plural Verbs	Proportion Singulars
Singular-Singular Preverbal (Statement)	mass	0	83	0
	count	7	258	0.03
	animal	0	207	0
	human	0	83	0
Singular-Singular Postverbal (Question)	mass	56	32	0.64
	count	181	88	0.67
	animal	153	86	0.64
	human	63	37	0.63
Singular-Plural Preverbal (Question)	count	0	143	0
	animal	1	111	0.01
Plural-Singular Postverbal (Statement)	count	14	117	0.11
	animal	11	97	0.10

For the Lebanese speakers, there were three comparisons, which included the two conducted for the English speaking participants, plus an additional comparison for the effects of noun type and sentence type on adjective agreement.

Noun type x Sentence Type on Verb Agreement (when both conjuncts are singular)

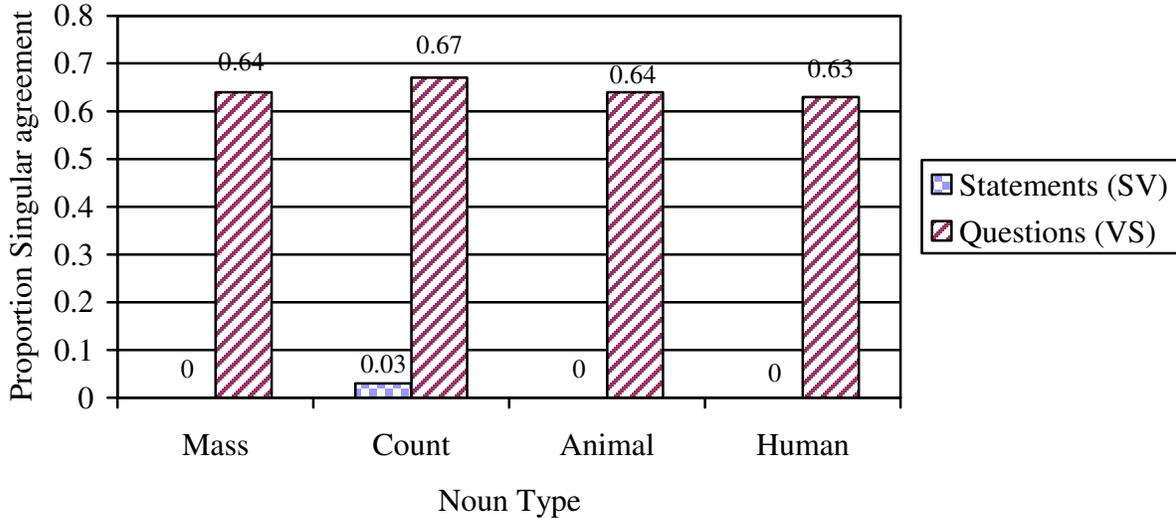
As shown in Table 6.17, the effect of sentence type (word order) is significant, but there is no visible effect of noun type on verb agreement, and the interaction between sentence type and noun type is not significant either (all Fs < 1).

Table 6.17 Analysis of Variance Results for Verb Number, Noun Type x Sentence Type, Exp. 5 – Lebanese Speakers (singular conjuncts only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Type	(3,21)	0.7*	(3,52)	0.1*	(3,65)	0.1*
Sentence Type	(1,7)	43.5	(1,52)	657.0	(1,8)	40.8
Noun Type x Sentence Type	(3,21)	0.2*	(3,52)	0.3*	(3,49)	0.1*

Figure 6.10 shows the overall proportions of singular agreement based on noun type and sentence type for conjoined singular nouns.

Figure 6.10 Proportion Singular Verb Agreement for Singular-Singular Conjunctions by Sentence Type and Noun Type, Experiment 5 - Lebanese Speakers



In this comparison, only the relative difference between the preverbal and postverbal conditions exceeded the values of the 95% confidence intervals, which were .02 for participants and .05 for items, showing that the position of the subject relative to the verb has a strong impact on agreement patterns.

The next comparison for Experiment 5 included the noun number manipulation for the Lebanese-speaking participants, which isolated the impact of lexically-specified plurality on the closest conjunct on agreement with conjoined noun phrases.

Noun Number x Sentence Type x Noun Type (for count nouns and animals)

As shown in Table 6.18, this yielded significant main effects of noun number and sentence type, and the interaction between noun number and sentence type was also significant. Noun type showed no effect (all $F_s < 1$).

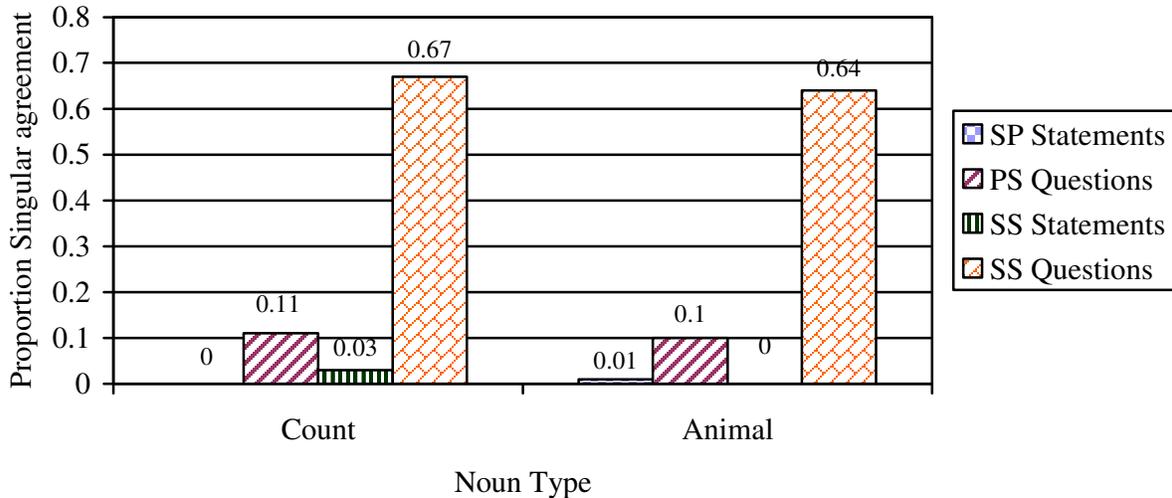
Table 6.18 Analysis of Variance Results for Verb Number, Sentence Type x Noun Number x Noun Type, Exp. 5 – Lebanese Speakers (count nouns and animals only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Number	(1,7)	43.5	(1,22)	293.2	(1,9)	37.9
Sentence Type	(1,7)	45.4	(1,22)	445.5	(1,8)	41.2
Noun Type	(1,7)	0.1*	(1,22)	0.2*	(1,22)	0.1*
Noun Number x Sentence Type	(1,7)	43.8	(1,22)	375.2	(1,9)	39.2

Figure 6.11 shows the overall proportions of singular agreement based on noun number, sentence type, and noun type. As with the English-speaking participants, the rate of singular agreement was higher when both of the nouns were singular than when the closest noun was plural, for both preverbal and postverbal subjects.

The Lebanese speakers showed an even greater tendency toward singular agreement with postverbal conjoined subjects than the English speakers. However, despite a difference in the magnitude of the effects, the overall patterns are similar. Preverbal conjoined subjects elicited very low proportions of singular verbs, while singular agreement was more likely with postverbal subjects. The highest rates of singular agreement were with singular-singular postverbal subjects, and the rate of singular agreement dropped sharply when the closest conjunct was plural.

Figure 6.11 Proportion Singular Verb Agreement for Count and Animal Conjunctions by Sentence Type and Noun Number, Experiment 5 - Lebanese Speakers



The relative difference between the SS Questions and between the PS Questions exceeded the values of the 95% confidence intervals, which were .03 for both participants and items, showing that the introduction of a plural lexical item in the closest conjunct position strongly reduces the rate of singular agreement for agreement with conjoined subjects.

Verb Gender

When the verbs were singular, they were marked either as masculine or feminine. The patterns of gender agreement that arise when the closest conjunct is feminine can provide information as to whether the singular verbs are derived from a lack of agreement or whether they are true instances of first conjunct agreement. This is particularly helpful when the first conjunct is feminine and the second is masculine: Since both default agreement and resolution rules would cause masculine agreement to appear, when the verb shows feminine agreement, this is evidence of first conjunct agreement. Table 6.19 shows the breakdown in gender agreement on singular verbs for singular-singular postverbal nouns. These categories were chosen for the

gender analysis because they represent where first conjunct agreement would appear (postverbally), and when both nouns are singular, this increases the likelihood of singular agreement (and therefore gender agreement) being realized on the verb.

Table 6.19: Distribution of Gender Agreement on Verbs by Gender of Subject Nouns for Singular-Singular Postverbal Subjects, Exp. 5 – Lebanese Speakers

	Feminine Singular	Masculine Singular
Feminine-Feminine	129	9
Feminine-Masculine	79	15
Masculine-Feminine	4	94
Masculine-Masculine	3	117

The majority of verbs agreed with the closest noun in gender, especially when there was no mismatch between the gender of the two nouns²⁵. The feminine-masculine conjunctions, which were of the form V+Fem+Masc+Adj, showed the greatest degree of gender disagreement (19%) of all the gender combinations. The feminine-feminine conjunctions also showed 7% masculine-singular (default) agreement, indicating that not all singular verbs produced can be attributed to closest conjunct agreement.

Adjective Number

There was one additional agreement target for the Lebanese participants that did not vary according to its sentence position, the adjective. For the postverbal subjects, this provided a window into whether the conjunctions *themselves* were singular or whether word order was

²⁵ One more interesting thing to note is that there were fewer singular verbs produced when the conjuncts mismatched in gender. This could be due to variation between the items themselves, or it could be due to a preference to use full agreement when there is a mismatch in features between the two conjuncts. Aoun, Benmamoun, & Sportiche (1994) had reported that first conjunct agreement was not the preferred option when nouns mismatched in gender.

causing the singular agreement observed on the preverbal subjects. If there is something special about postverbal conjoined subjects in Arabic, such that they obtain a singular number marking (Soltan, 2007), then other agreement targets in the same sentence should express that same singular number, consistent with the number on the verb. If, however, the crucial difference is in how the conjoined subject *interacts* with the verb because of word order, then sentence-final targets (such as adjectives) should uniformly express plural agreement, similar to the behavior of verbs that have preverbal subjects.

Adjectives were the sentence-final agreement targets for both sentence types (statements and questions). Since adjectives are also marked for number in Arabic, in addition to scoring the verbs by their agreement features, adjectives were also scored according to their number (and gender²⁶) marking. Table 6.20 shows the distribution of number marking on adjectives.

Table 6.20: Distribution of Responses for Adjective Number over Scoring Categories for Noun Number, Noun Type, and Word Order Manipulation, Exp. 5 – Lebanese Speakers

Conjunct Type	Singular	Plural	Proportion Singulars	Misc.
Singular-Singular + V + Adjective	4	637	<0.01	255
V + Singular-Singular + Adjective	16	680	0.02	200
Singular-Plural + V + Adjective	0	255	0	129
V + Plural-Singular + Adjective	6	234	0.02	144

²⁶ In Lebanese Arabic, gender is almost always neutralized in the plural, so there is only gender marking available when the verbs and adjectives were singular. Because of the scarcity of singularly-marked adjectives, the distribution of gender over the adjectives is not reported.

An additional comparison contrasted the effects of noun number and sentence type on adjective agreement. Because most of the singular adjectives occurred when both of the conjuncts were singular, the comparison includes only the singular-singular conjunctions.

Noun type x Word order on Adjective Agreement

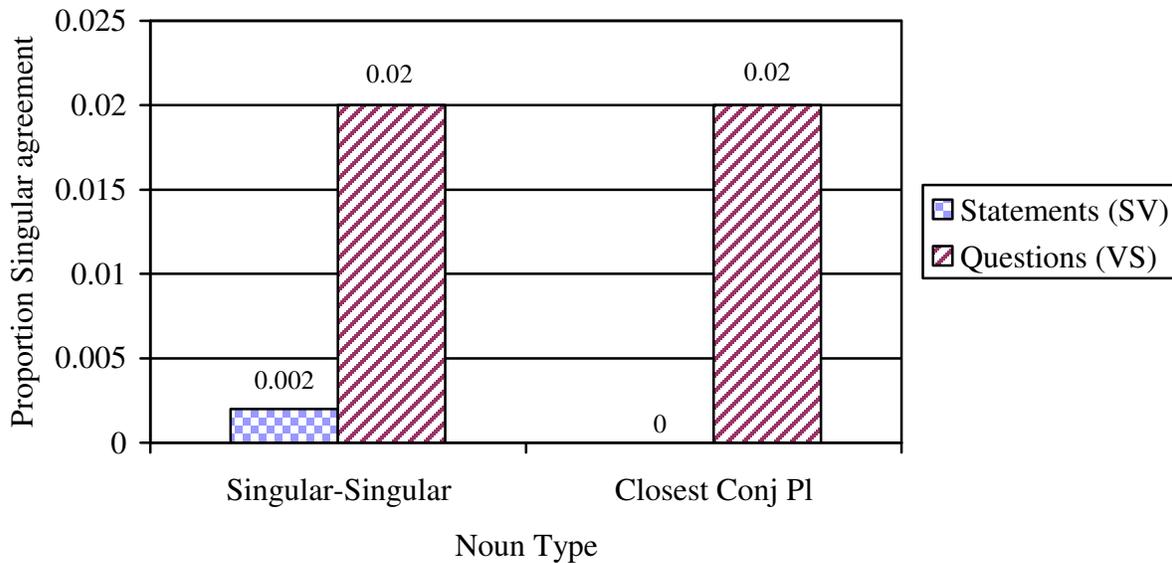
As shown in Table 6.21, there were main effects of sentence type and noun type and of the interaction between sentence type and noun type in both the participants and items analyses, although the minF' calculations failed to reach the p=.05 level of significance for all three effects.

Table 6.21 Analysis of Variance Results for Agreement on Adjectives, Noun Type x Sentence Type, Exp. 5 – Lebanese Speakers (singular conjuncts only)

	By participants		By items		min F'	
	Degrees of freedom	F ₁ value	Degrees of freedom	F ₂ value	Degrees of freedom	F value
Noun Type	(3,21)	3.1	(3,52)	2.7	(3,63)	1.4*
Sentence Type	(1,7)	9.4	(1,52)	5.1	(1,39)	3.3*
Noun Type x Sentence Type	(3,21)	3.1	(3,52)	2.8	(3,62)	1.5*

Figure 6.12 shows the overall proportions of singular agreement on adjectives based on noun number and sentence type for conjoined singular nouns. This graph demonstrates the rarity of singular agreement on adjectives, which were always sentence-final targets (and therefore linearly rightward of the conjoined noun phrase.)

Figure 6.12 Proportion Singular Adjective Agreement for Sentence Type and Noun Type, Experiment 5 - Lebanese Speakers



In this comparison, the relative differences between the preverbal and postverbal subjects, met or exceeded the values of the 95% confidence intervals, which were .01 for participants and .02 for items. Even though adjectives were almost uniformly plural, there was still a greater tendency toward producing plural adjective agreement with preverbal subjects. 5 singular adjectives occurred with plural verbs, and the remaining 21 singular adjectives occurred with singular verbs. The conditional probability of obtaining a singular adjective given a singular verb was 0.56 for preverbal singular-singular subjects, 0.03 for postverbal singular-singular subjects, and 0.08 for postverbal plural-singular subjects.

All the singular adjectives occurred when the closest conjunct to it was singular (namely in the singular-singular or plural-singular conditions). Out of the 26 singular adjectives, all but one can be explained by two patterns of agreement: default agreement (masculine singular) and

closest conjunct agreement²⁷. With the 4 singular adjectives with preverbal singular-singular subjects, all the adjectives occurred immediately following singular verbs that agreed with the closest conjunct in number and gender.

With the 15 postverbal singular-singular conjuncts, all occurred with singular verbs, 5 clearly involved closest conjunct agreement on both the verb and the adjective, and the other 10 could be explained through default agreement (although it is impossible differentiate between closest conjunct agreement and default agreement with the masculine-masculine conjunctions). The remaining 6 singular adjectives occurred with postverbal plural-singular conjunctions. Two had default (masculine singular) agreement on both the adjective and the verb, and the remaining 4 instances showed closest conjunct (plural) agreement on the verb and closest conjunct agreement (singular, agreeing in gender) on the adjective.

Discussion

Experiment 5 showed a significant effect of sentence type, with more singular verbs produced with postverbal subjects (questions) than with preverbal subjects (statements) in both Lebanese Arabic and English, just as with Experiments 3 and 4. There were a few differences, however, between the Lebanese and English speakers: There was a much higher rate of singular agreement for postverbal subjects in Lebanese Arabic than in English, and the Lebanese speakers also seemed to be less sensitive to the notional properties of the conjunctions. Since adjectives inflect for number and gender agreement in Arabic, they functioned as additional agreement targets. In the statement tasks, both the adjective and the verb were produced after the subject, and they displayed almost no singular agreement. In the question task, the Lebanese speakers

²⁷ The remaining error, “Kanu eljizdan wel efel 7amra?” (Are the purse and padlock red.FS?) could potentially be explained by the pattern in Modern Standard Arabic to use feminine singular agreement for inanimate plurals, but this pattern only occurs once among all the collected responses, and would need to be replicated before justifying an explanation.

produced 64% singular agreement on verbs, but only 2% singular adjectives, indicating that the conjunctions themselves were not marked as singular but that the word order of the verb relative to the subject was causing the elevated rates of singular agreement on verbs. Gender data showed that many of the instances of singular agreement with conjoined subjects could be attributed to closest conjunct agreement but that others (between 7-19%) were exhibiting default agreement.

The English speakers produced 19% singular agreement on verbs for postverbal singular-singular subjects. The presence of plural conjuncts reduced the rate of singular agreement in both English and Lebanese Arabic but did not wipe it out entirely for postverbal subjects, providing additional evidence that first conjunct agreement is not solely responsible for the singular verbs produced with conjoined noun phrases in either Lebanese Arabic or in English²⁸. Grammaticality preference tasks with the Lebanese Arabic speakers confirmed the results for Lebanese Arabic: Agreement targets that occur after conjoined subjects are required to be plural, but verbs that occur before the subject nouns have more flexibility in agreement.

General Discussion

Comparing agreement in languages with and without first conjunct agreement provides a unique window into the agreement production processes. From the differences in the rates of singular agreement between the Lebanese and English speakers, it is clear that the Lebanese speakers are given more freedom by their grammar to produce singular verbs than the English speakers have, and the relative equivalence between the rates of singular agreement between mass nouns, count nouns, animals, and humans in Lebanese indicates that the singular agreement is not being driven entirely by notional influences. An analysis of gender agreement

²⁸ The Lebanese agreement patterns are also not due to participants' resorting to Standard Arabic grammar, which requires singular agreement for postverbal subjects, as plural subjects occurring in interrogatives produced low rates of singular agreement (11% singular verbs when the closest conjunct was plural in interrogatives), while Standard Arabic would have required singular agreement for all lexically plural postverbal subjects.

further confirms that the majority of singular verbs in Lebanese Arabic are exhibiting first conjunct agreement, although this still does not explain all instances of singular agreement: There are verbs that fail to agree in gender for each of the gender combinations of subject nouns. Similarly, singular agreement was produced for 11% of verbs when the first conjunct following the verb was plural, so the singular agreement arising in these contexts could not be derived from the number marking on the closest noun.

Mixed Agreement

For both English and Lebanese Arabic, word order of the subject relative to the verb was the most important factor in determining agreement, as preverbal subjects in both languages elicited almost uniformly plural agreement in the picture description tasks, even without the inclusion of a plural noun. In Lebanese Arabic, the adjective provided an additional agreement target that provided an opportunity to isolate the influence of word order between an agreement source and its target. The adjectives were almost uniformly plural, while verbs (that occurred sentence-initially) in the same sentences showed a strong tendency toward singular agreement, indicating that the target-source word order is crucial in determining agreement. Sentence (9) was produced by one of the Lebanese participants, and it demonstrates this type of “mixed” agreement: The verb is feminine singular, agreeing with the first noun, but the adjective following the subject is plural.

9. kanit elbatta wel wazzi khuder. (Lebanese Arabic)

was.FS the.duck.FS and.the swan.FS green.PL

‘Was the duck and the swan green?’

Several other languages have also shown evidence of mixed agreement on predicative targets. McCloskey (1986) provides examples of mixed agreement (first conjunct agreement with

one element and full agreement with another) from Irish. The examples in (10) show the patterns of agreement with a single subject, and the sentences in (11) demonstrate the mixed agreement that occurs with conjoined subjects. In sentences (11a & b), the second conjunct has a plural clitic, while the verb shows singular agreement, consistent with the first conjunct. Welsh also shows evidence of mixed agreement (12), from (Sadler, 2003)²⁹.

10. a) Tá mé ‘mo dhochtúir. (Irish)

am I 1S doctor

‘I am a doctor.’

b) Tá mé ‘mo sheasamh.

am I 1S stand VN

‘I am standing.’

11. a) Ta´ mise agus mo dheartha´ir ´na´r ndochtu´ir´1.

am I CONTR and my brother 1PL doctors

‘My brother and I are doctors.’

b) Bhi´nn pro-fe´in agus an seandúine ´na´r sui´.

be.PAST.HAB.1SG pro-EMPH and the old fellow 1PL sit

‘The old fellow and I used to be sitting.’

12. Dw i a Gwenllian heb gael ein talu. (Welsh)

am.1S 1S and Gwenllian without get 1PL pay

‘Gwenllian and I have not been paid.’

Munn (1999) provides additional examples of mixed agreement from Brazilian Portuguese (13).

The first type of mixed agreement occurs with sentences that have both prenominal and postnominal adjectives. In Brazilian Portuguese, prenominal adjectives and (prenominal)

²⁹ It should be noted that Welsh only exhibits verb agreement with pronominal subjects.

determiners must agree with the first conjunct, while postnominal adjectives require full agreement, although semantically both prenominal and postnominal adjectives take scope over both conjuncts. In addition to mixed agreement with adjectival targets, Brazilian Portuguese also shows mixed agreement with verbs (14).

13. a) Eu encontrei as minhas velhas amigas e amigos famosos.

I met the.FPL my.FPL old.FPL friends.FPL and friends.MPL famous.MPL

‘I met my famous old female friends and (my famous old) male friends.’

b) *Eu encontrei os meus velhos amigos e amigos famosos.

I met the.MPL my.MPL old.MPL friends.FPL and friends.MPL famous.MPL

c) *Eu encontrei os meus velhas amigas e amigos famosos.

I met the.MPL my.MPL old.FPL friends.FPL and friends.MPL famous.MPL

d) Eu encontrei os meus velhos amigos e amigas famosos.

I met the.MPL my.MPL old.MPL friends.MPL and friends.FPL famous.MPL

‘I met my famous old male friends and (my famous old) female friends.’

14. Fui eu e as meninas que compramos as flores.

was.1S I and the girls who bought.1PL the flowers

‘It was me and the girls who bought the flowers.’

In all these sentences (9, 11-14) it is the word order that determines the agreement relationships.

When agreement targets are postnominal, they obligatorily reflect the resolved values of the conjoined noun phrase, but when they are prenominal, agreement targets have the ability to form relationships with just the first conjunct.

Summary

This chapter reported on three sentence elicitation experiments that varied noun number, (semantic) noun type, and position of the subject relative to the verb in English and Lebanese Arabic. Experiments 3 & 4 also provided a contrast of linear proximity between the plural noun and the verb in English, manipulating whether the closest conjunct or the furthest conjunct was plural in both preverbal and postverbal word orders. Speakers of Lebanese Arabic and English were more likely to produce plural agreement when the subject preceded the verb, and plural nouns increased the likelihood of plural agreement, especially if they were linearly proximate to the verb. However, the tendency to produce singular agreement with conjoined postverbal subjects was not completely overruled by the introduction of a plural noun in the closest conjunct position, and combined with data from gender agreement, this shows that not all singular agreement produced with postverbal subjects can be attributed to effects of closest conjunct agreement. Finally, the effect of noun type for the English speakers confirms the results from Experiments 1 & 2 (Chapter 5), providing further evidence that notional number influences agreement with conjoined subjects, at least in English. The Lebanese Arabic speakers showed no tendency toward notional number agreement. Because of the modality of the task which emphasized plural construal, however, it is not possible to rule out notional number effects in Lebanese Arabic.

Chapter 7 will discuss how the results from this set of experiments, as well as the experiments presented in Chapter 5 and the corpus data, can be incorporated into psycholinguistic and syntactic models of agreement.

CHAPTER 7: SYNTACTIC AND PSYCHOLINGUISTIC IMPLICATIONS

“Now I said the choir and the competition is out.” – Sister Act II

The agreement production studies can be summarized into a few major findings. First, agreement with conjoined subjects can elicit either plural or singular verbs, and singular agreement is common, especially when both of the conjuncts are singular. Second, word order plays a large role in agreement production, and targets following conjoined subjects are much more likely to exhibit full agreement than targets that precede conjoined subjects, meaning that full agreement is more common in Subject-Verb orders and that sentence-final adjectives, which follow the agreement controllers, also show full agreement. This asymmetry holds for languages with the option of closest conjunct agreement (e.g., Lebanese Arabic) and for languages without closest conjunct agreement (e.g., English). Third, linear proximity also plays a role in agreement: When plural conjuncts are linearly proximate to the verb, they cause a large reduction in the rate of singular agreement. Fourth, semantics, as measured by noun type, has been shown to play a role in influencing agreement with conjoined subjects in English, and may also be at work in Lebanese Arabic, although the influence of noun type was not as evident during the picture description task for the speakers of Lebanese Arabic. Finally, there were interactions between noun number and word order when the closest conjunct is plural, for both English and Lebanese Arabic speakers, such that plural nouns in closest conjunct position almost never elicited singular agreement, but with postverbal subjects, when the closest conjunct was plural, there were still more singular verbs produced than in any of the preverbal subject conditions.

This chapter will first discuss how the results from the corpus study and the experiments fit into the syntactic theories presented in Chapter 2 and will outline the syntactic mechanisms that are needed to account for agreement with conjoined subjects. Then, from the syntactic

mechanisms, I will discuss how the results of these experiments fit into psycholinguistic models of language production, focusing specifically on issues of lexical number, word order, and how many stages are involved in the production of agreement.

Syntactic Implications for Analyses of Closest Conjunct Agreement

The patterns of agreement from both the English and Lebanese speakers can provide helpful information about how agreement with conjoined subjects works, and especially about the nature of closest conjunct agreement. The adjective data from the Lebanese speakers show that, even when the verb does not express plural morphology during first conjunct agreement, the conjoined noun phrase is still plural, since the adjective shows plural agreement. Gender agreement patterns show that, although the majority of singular verbs in the postverbal subject condition are due to closest conjunct agreement, not all singular verbs are attributable to agreement with the closest conjunct and that there is an additional preverbal/postverbal asymmetry that goes beyond the mechanisms of closest conjunct agreement. (The details of the syntactic analyses to be discussed are presented in Chapter 2.)

Principles and Parameters Accounts

The presence of the plural agreeing adjective in sentences with first conjunct agreement provides evidence that the conjunction itself is not singular. This rules out clausal conjunction analyses (Aoun et al., 1994; Aoun, Benmamoun, & Sportiche, 1999), since the plural adjectives that surface in the context of closest conjunct (verb) agreement show that the conjoined elements are phrases, and not separate clauses³⁰.

The plural agreement on adjectives also rules out a late-adjunction account for first conjunct agreement, such as was proposed by Soltan (2007) for Standard Arabic. In his account,

³⁰ The analyses of Aoun, Benmamoun, & Sportiche (1994;1999) were centered around Number-Sensitive Items and collective predicates such as “together”. It will be important to extend the language production research to encapsulate issues involved with collective interpretations and plural predicates.

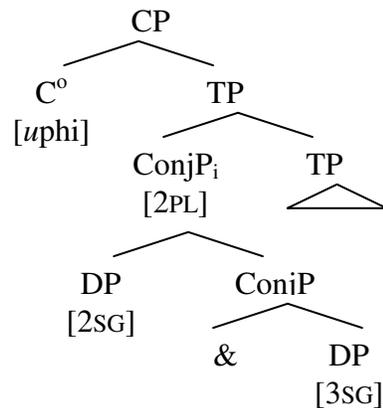
only the first conjunct is present when subject-verb agreement is computed, and then after the agreement relationships are established, the remaining noun is merged through post-cyclic late-adjunction. Soltan suggests that the difference between Standard Arabic and the dialects (when they express full agreement) is whether adjunction occurs early or late. Within this account, the singular agreement on the verb in Lebanese Arabic should imply that, with first conjunct agreement, adjunction is occurring late, but with the plural agreement on the adjective, merge could not have occurred post-cyclically, especially if one assumes a bottom-up derivation (Chomsky, 2001b).

Johannessen's (1996) account is also incompatible with the data from Lebanese Arabic, because she also proposes that the conjoined noun phrases are singular, that agreement occurs between the verb and the specifier of the conjoined noun phrase, and that plural agreement only arises due to semantic influences. Citko's (2005) account is also incompatible for similar reasons – she proposes that bare conjoined noun phrases are singular and that they only become plural when null plural pronouns are inserted. However, with singular verbs (which are assumed to occur in the absence of the null plural pronominals), singular agreement on adjectives would be expected, but this is not the pattern that was obtained in our data.

Two of the proposals within the Principles and Parameters framework can, however, provide some helpful insight into how to approach the agreement patterns in Lebanese Arabic. In van Koppen's (2006) analysis, agreement is calculated at PF. There can be multiple agreement Goals in a sentence, and each Goal can generate a search for an agreement feature, which allows complementizers (which occur before the subject) to show closest conjunct agreement, while verbs (which occur after the subject) show full agreement in Dutch. Because the complementizer is equally local to the first conjunct and the conjunction phrase as a whole, either first conjunct

agreement or full agreement is available. However, when the verb occurs after the subject, there is only one potential (local) source for agreement (1), and the verb agrees with the whole conjunct.

1.



The choice between first conjunct agreement and full agreement on the complementizer, according to his account, depends on the post-syntactic lexicon and which affixes have the most morphological information, according to the Subset Principle (2) (Halle, 1997).

2. Subset Principle

“The phonological exponent of a Vocabulary Item is inserted into a morpheme in the terminal string if the item matches all or a subset of the grammatical features specified in the terminal morpheme... Where several Vocabulary Items meet the conditions for insertion, the item matching the greatest number of features specified in the terminal morpheme must be chosen.”

This principle provides a natural explanation for why first conjunct agreement occurs in some varieties of Dutch and not others, and also provides a natural explanation for the way some languages exhibit first conjunct agreement only with certain cells in the morphological paradigm, as in Bavarian, which only shows complementizer agreement with subjects in the second person.

The important mechanism of van Koppen's account is that each Goal can generate a search for its own features, which is crucial for being able to explain mixed agreement effects. He also provides a natural explanation for the ability of prenominal targets to exhibit first conjunct agreement, while postnominal targets show full agreement, a pattern that is common cross-linguistically. The limitation of van Koppen's account, however, is that it cannot explain the optionality of first conjunct agreement, as is observed in the Arabic dialects, and likely in other languages as well (e.g., Russian, Polish, Czech, German, and English), where there is no difference in the morphological informativeness of the affixes.

Munn's account (1999) also uses locality asymmetries to explain the difference between the patterns of agreement with preverbal and postverbal conjoined subjects. In his account, preverbal conjoined subjects reflect full agreement because they are in a specifier-head relationship to the verb. (Agreement under specifier-head relationships was first proposed by Benmamoun (1991).) Postverbal conjoined subjects can reflect first conjunct agreement through agreement under government. Munn argues that first conjunct agreement never occurs in specifier-head configurations and that, cross-linguistically, first conjunct agreement arises wherever agreement under government exists. However, subjects and verbs are in specifier-head relationships when subjects linearly precede the verb, and the Spec-Head account of full agreement will be contrasted against a purely linear account for agreement asymmetries later in this chapter.

Non-Principles and Parameters Accounts:

In Lexical-Functional Grammar (LFG), Sadler's proposal (2003) for first conjunct agreement involves stipulating that each noun has two sets of features at f-structure. For non-conjoined subjects, these two sets of features are identical. For conjoined subjects, one set of

features reflect the resolved features of the conjunction as a whole, and the other set of features are equivalent to those on the first conjunct. In Welsh, which shows full agreement on post-nominal targets (e.g., reflexive anaphors, predicate adjectives) the resolved features are used, but the prenominal targets (e.g., prepositions) show first conjunct agreement. These features are named IND and AGR, to reflect the different types of agreement, “index” and “concord”, which have been widely used to capture agreement patterns in Head-Driven Phrase Structure Grammar (HPSG) (Pollard & Sag, 1994).

While this provides two sets of agreement features for the conjoined noun phrase, it fails to explain why one type of agreement feature would be relevant for postnominal agreement while the other is relevant to prenominal targets. Similarly, since conjunctions are considered sets in LFG, there is no reason that the closest conjunct should be given a special agreement feature that is relevant to agreement, while the AGR features on the other nouns are irrelevant.

The HPSG analysis addresses these problems by providing mechanisms by which both the leftmost and rightmost conjunct can be accessible to agreement, with three features for each noun phrase (LAGR, RAGR, & CONCORD). Since this analysis is shaped around instances of mixed agreement (in which prenominal targets have different values than postnominal targets), it can handle the difference in agreement features expressed on verbs and adjectives from the Lebanese data in Experiment 5. The types of agreement that are allowed for prenominal and postnominal targets are stipulated in terms of constraints. In other words, the framework for single conjunct agreement in HPSG (Villavicencio et al., 2005) should allow first and second conjunct agreement as well as full agreement for all targets, whether they be prenominal or postnominal, subject to the constraints of a language. This analysis, however, ignores the cross-linguistic tendency toward reduced agreement with postverbal subjects and the fundamental differences in

many languages between agreement with preverbal and postverbal subjects. It also over-generates and would predict last conjunct agreement with postverbal subjects, a pattern that is cross-linguistically unattested (Corbett, 2006).

As with the HPSG analysis, the Optimality-Theoretic analysis (Badecker, 2007) was also designed specifically to address mixed agreement with conjoined subjects and can therefore account for mismatches in features on prenominal and postnominal targets, using the distinction between agreement under extended projection and Spec-head agreement, and capturing the optionality of agreement and the sensitivity to semantic constraints through a distinction between agreement between index and concord agreement on conjoined noun phrases. For languages (e.g., Welsh) in which partial agreement is obligatory and carries no semantic constraints, agreement is calculated based on concord features, and since the conjoined noun phrase as a whole does not carry concord features, agreement is with the closest concord feature (because of alignment constraints) – and therefore with the closest conjunct. For languages (e.g., Lebanese Arabic and Modern Greek) in which partial agreement is optional and is impossible with collective predicates, agreement is calculated based on index features. The conjoined NP may or may not be indexed, depending on its referential value. If the subject NP is indexed (as it would be with collective predicates), then full agreement is required. If it is otherwise unindexed, partial agreement (with the closest conjunct) occurs instead.

The preverbal/postverbal asymmetry in Arabic is captured by an extra constraint that would require that subjects in SpecCP must bear their own index, which would enforce full agreement for preverbal subjects. Languages, like Czech, German, and English, which have optional partial agreement but do not bear any semantic constraints, have equally-ranked concord

and index agreement constraints, and partial agreement occurs when agreement is with the concord features.

Badecker's (2007) account therefore can handle the preverbal and postverbal asymmetries by employing two types of agreement relationships, which are essentially agreement under government and specifier-head agreement. He also accounts for the cross-linguistic tendency toward closest conjunct agreement through alignment constraints. By capitalizing on the differences between index and concord agreement, he parameterizes the languages that exhibit closest conjunct agreement based on whether or not partial agreement is obligatory and whether it carries any semantic constraints³¹. When full agreement is required with preverbal subjects, an additional constraint specifies that subjects in SpecCP must bear their own index, making concord agreement impossible. This account is very broad and is able to capture a wide range of issues involved in closest conjunct agreement, and a similar explanation has been proposed within a Minimalist framework (Marušič et al., 2007), which is also able to account for default, non-agreement.

This Minimalist analysis capitalizes on Badecker's idea that features can be missing from a conjoined noun phrase, which allows agreement with one of the conjuncts (or, if neither of the conjuncts is available, allows default agreement) if the necessary feature is not available on the full conjoined noun phrase. Instead of making a distinction between index and concord agreement, Marušič et al. (2007) differentiate between gender and number agreement themselves by saying that the ConjP does not compute a gender value. Number and gender agreement would be computed independently, with split phi-Probes, and closest conjunct agreement in gender would occur with the application of "SECOND-AGREE". Since the ConjP does not have a gender

³¹ Badecker (2007) tentatively suggests that issues such as animacy, definiteness, and concreteness can affect agreement, and therefore could serve as conditions on the indexes of conjoined NPs.

value, the Probe would continue until it reached its Goal inside the ConjP, and if two accessible Goals are located, agreement occurs with the closest conjunct. This fits with patterns of closest conjunct agreement in Icelandic and Portuguese, in which there may be closest conjunct agreement in gender, while number agreement often reflects the resolved value of the ConjP³².

Syntactic/Psycholinguistic Analysis

In addition to the purely syntactic analyses presented above, Franck et al. (2006) used psycholinguistic evidence to build a syntactic analysis of agreement attraction, and their analysis includes mechanisms that are relevant to the phenomenon of closest conjunct agreement, including hierarchical structure and linear precedence. They proposed two distinct mechanisms involved in agreement, checking (AGREE), which occurs based on the original hierarchical structure of the sentence, and verification, for subjects that have moved into Spec-head relationships with their targets. This “check” and “double-check” mechanism should be applicable to the asymmetry between preverbal and postverbal conjoined subjects as well, since preverbal subjects would be checked and verified, while postverbal subjects would only undergo the process of checking (AGREE) once. The intuition is that subjects that are in a strictly local Spec-head relationship are better able to ensure that agreement values match, and in Experiments 3-5, participants did use more singular agreement with postverbal subjects, even when the closest conjunct was plural, showing that the preverbal/postverbal asymmetry extends beyond the option of first conjunct agreement.

Spec-Head or Linear Precedence?

The question that remains, however, is whether this extra verification mechanism comes from the Spec-head agreement relationship or whether it occurs because the subject linearly

³² If there is “resolved” gender agreement Marušič et al. (2007) suggest that this is default agreement instead. They make an interesting point, since gender resolution rules often conflate resolved gender agreement with default gender agreement. More exploration into multiple-gendered languages is certainly needed to address this issue.

precedes the object with no material intervening between the subject and the verb. There has been a push within the Minimalist Program to account for all agreement phenomena through the relation AGREE, eliminating the need for Spec-head agreement (Chomsky, 2001b) and instead enriching the work of PF in agreement (Bobaljik, 2007).

One attempt to reduce Spec-head agreement to linear precedence (Ortega-Santos, 2006) relies crucially upon the left-to-right building of syntax (Phillips, 1996), rather than a bottom-up approach. In this approach, first conjunct agreement occurs when the T (“Tense” head of the TP) and the first conjunct establish agreement at the first stage of the derivation. Then ConjP and the second conjunct are merged, breaking the constituency between the verb and the first conjunct. This would allow later (postnominal) targets to show resolved agreement, since the conjuncts have merged into a constituent by the time agreement is established with postnominal targets. This system can also derive default agreement for postverbal subjects, which would occur if the verb needed to be produced before the subject had been encoded, for the purposes of faster production. With preverbal subjects, the subject is always available to the verb, since it precedes the verb, so full agreement should always be expected with preverbal subjects.

Linear Proximity

This question of whether full agreement is assured via Spec-head configurations or linear precedence of the subject is still under debate. However, the effects of linear proximity for preverbal subjects as observed with conjunctions (in the corpus study and Experiments 3-5), as well as in disjunctions (Haskell & MacDonald, 2005), support a linear precedence analysis, since that alone should predict proximity effects with preverbal subjects. From an activation-based perspective, the tendency to agree with the linearly proximate element is due to a suppression of the first conjunct while subject-verb agreement is being computed for preverbal subjects, and

higher activation for the first conjunct with postverbal subjects. Since nouns and verbs that are co-activated often agree with each other, co-activation is a cue for subject-verb agreement (Haskell & MacDonald, 2005), although the singular-plural markedness asymmetry would still need to be explained, as would the fact that closest-conjunct agreement happens more often in postverbal contexts than with preverbal subjects, which would not be predicted by the activation-based perspective.

One other possible explanation is that the effect of linear proximity is due to self-monitoring. From a monitoring perspective, local coherence is important (Tabor et al., 2004). The difference between the agreement patterns for preverbal vs. postverbal subjects can be explained through prosodic groupings: Preverbal subjects form an independent prosodic unit, while postverbal subjects are prosodically grouped with their verb. For conjoined postverbal subjects, the first conjunct can form a prosodic unit with the verb (Benmamoun & Lorimor, 2006), and if monitoring operates on prosodic units, this would explain why more plurals are produced with preverbal subjects than with postverbal subjects. One way to gauge what speakers are processing is to look at the patterns of their self-corrections³³. If local coherence is driving the linear proximity effect, the pattern of self-corrections should always be toward agreeing with the closest conjunct and, in the absence of self-corrections, there should be no closest conjunct agreement (if monitoring alone is driving the phenomenon), although some of these self-corrections could occur internally, before the speech stream is articulated.

Self-Corrections

Across Experiments 3, 4, and 5 there were 5120 responses in each of the preverbal and postverbal conditions. For the preverbal sentences, there were only three instances of self-

³³ Admittedly, self-corrections are difficult to disentangle, since they can occur due to hyper-corrections, prescriptive pressures, or memory lapses.

correction (<0.1%), and all of the self-corrections involved participants changing singular verbs to plural verbs when a singular noun was in the closest conjunct position. (The period (.) indicates a hesitancy in speech.)

3. a) The swans and the duck was.were blue.
- b) The sh.the spoon and the fork was were red.
- c) The wood and the gasoline was.were green.

These self-corrections, which all changed the verb from singular to plural, indicate that speakers were aware that they had erroneously formed agreement relationships with the local noun, and that they all intended to produce plural agreement.

The pattern of self-corrections with postverbal subjects was much more complicated. For the sentences with postverbal subjects, there were 41 instances of self-correction on verb number, amounting to 0.8% of the total responses. 28 (68%) were from singular to plural verbs, while the remaining 13 (32%) were from plural to singular. Noun number influenced the patterns of corrections. When the closest conjunct was plural (Plural-singular conditions), 100% (5 out of 5) of the self-corrections were toward the plural (4).

4. Was the.were the candles and pot blue?

When the furthest conjunct was plural (Singular-plural conditions), only 42% (5 out of 12) of the self-corrections were toward the plural, and the remaining were toward the singular (5).

5. Were the. was the butterfly and grasshoppers red?

When both conjuncts were singular (Singular-singular conditions), 75% (18 out of 24) of the self-corrections were toward the plural, and when mass nouns were excluded because of their potential notional singularity (6), 85% of the self-corrections were toward the plural (17 out of 20).

6. Were.was the popcorn and the butter blue?

The self-corrections provide tentative evidence that the effects of linear proximity are not being driven entirely by local coherence. Instead, participants are regularly switching verb agreement away from the local noun and toward the whole conjunction. This tendency toward self-correction was observed among a wide range of participants, and 33 out of the 52 participants who produced sentences with postverbal subjects made at least one self-correction on verb number, the majority of which were toward plural agreement.

Instead of local coherence, a better explanation for the pattern of self-corrections with postverbal subjects is that participants have access to two agreement controllers: the local noun and the conjoined noun phrase. This could be explained via a locality account, in which both the closest conjunct and the conjoined noun phrase are structurally equidistant from the controller (van Koppen, 2006). And it is this equidistance that makes the option of first conjunct agreement possible. Alternatively, a constituent reanalysis approach based on linear relationships (Ortega-Santos, 2006) could also explain the pattern of self-corrections toward the plural with postverbal subjects, although there would need to be an additional mechanism for self-corrections toward the singular within the constituent-reanalysis approach, since only plural corrections would be predicted.

One or Two Stages of Agreement?

One additional question that has been a recurring theme in this work is whether agreement is computed in one stage or in two and whether it is computed based on hierarchical or linear relationships. The original psycholinguistic studies comparing the effects of hierarchical structure and linear order on agreement (Franck et al., 2002; Vigliocco & Nicol, 1998) showed little/no effect of linear order and therefore argued that agreement is computed once, at the

functional level, before linear order is assigned. However, more recent work on agreement with disjunctions (Haskell & MacDonald, 2005) and agreement attraction (Franck et al., 2006) has shown that linear order does play a role in agreement production, motivating analyses in which agreement is (at least partially) computed during linearization. Franck et al. (2006) suggest a two-stage model that involves an agreement checking operation based on the hierarchical representation, but then an additional step of verification after movement, when subjects are in a strictly local Spec-head configuration.

Many of the current minimalist syntactic theories are moving toward an analysis of agreement as a strictly PF-phenomenon (Bobaljik, 2007; Marušič et al., 2007; Sigurðsson, 2004; van Koppen, 2006). However, a strictly PF account of agreement is not able to explain the full range of agreement facts. For example, evidence from speech errors suggests that agreement is at least partially computed prior to linearization: Stem-exchange errors (7a&b) are often used as evidence for the necessity of agreement computation prior to linearization, since the agreement affixes can remain in the correct linear positions, while the stems are in the wrong place (Example (7a) from Stemberger (1982) , and (7b) from Garrett (Garrett, 1976)), and attraction results like those of Bock & Cutting (1992) are likewise hard to explain in terms of linear order alone.

7. a) Most cities are true of that. (Intended: That is true of most cities’)
 b) It waits to pay. (Intended: It pays to wait’)

A two-stage approach to agreement, similar to that proposed by Franck et al. (2006), is compatible with the results from this study and provides a mechanism to incorporate the semantic noun-type effects into a unified theory of agreement production. One caveat, however, is that merely forming a Spec-head relationship at some point in the derivation does not ensure

full agreement, and verification only occurs in a Spec-head configuration after linearization, at PF. This is because, in Arabic, there is strong evidence that the verb and subject are in a Spec-head relationship prior to linearization (Benmamoun, 2000b; Fassi Fehri, 1993; Mohammad, 1999), but full agreement is only required if the subject linearly precedes the verb at the end of the derivation.

Semantic (noun type) Influences on Agreement

The issue of semantic effects extends beyond whether or not single conjunct agreement is possible with collective predicates and bound (plural) anaphors. All three types of data collection employed in this project (i.e., corpus study, sentence completion task, picture description task) showed an effect of noun type on agreement for preverbal and postverbal subjects, at least for the English speakers. Plural agreement was more likely if the conjoined nouns were animals or humans, and less likely if the conjoined nouns were mass nouns or deverbals.

If agreement is a purely PF-phenomenon, there is no reason to expect that notional number valuations should affect the patterns of agreement. However, the evidence for notional number as an important factor in agreement has been extensively demonstrated with collective nouns and distributive interpretations (Humphreys & Bock, 2005) and with the patterns of agreement with mass nouns and deverbal nouns reported in this study.

On the other hand, a purely semantic account of number agreement with conjoined subjects is untenable because of the agreement asymmetries that are based on word order. In Experiments 3-5, both the English and the Lebanese Arabic speakers showed a strong tendency to use singular agreement with prenominal targets, but postnominal targets (i.e., postnominal verbs and agreeing adjectives) showed plural agreement with very little deviation. If semantics is at the core of number agreement with conjoined subjects, there is no reason to expect a

difference in agreement patterns between prenominal and postnominal targets, and mixed agreement in number (in which one target displays singular agreement, while another is plural) should similarly be impossible if number agreement is purely semantic in nature.

Conclusions

In summary, this study provides evidence for the role of lexical number, linear proximity, linear word order, and semantics in the production of agreement with conjoined subjects. Both the Lebanese Arabic and English speakers produced more plural agreement with preverbal subjects than with postverbal subjects, and for both sets of speakers, plural nouns in the closest conjunct position were stronger enforcers of plural agreement than plural nouns in the furthest conjunct position, for both preverbal and postverbal subjects.

This study also provided additional insight about the nature of first conjunct agreement. Because the Lebanese participants produced (sentence-final) plural adjectives in the same utterances as (sentence-initial) singular verbs, this demonstrates that the conjunction *itself* is not singular, but that the verb is reaching within the conjoined noun phrase to obtain its agreement properties from the first conjunct. This is possible because of the hierarchical structure, in which both the closest conjunct and the conjoined noun phrase are equally local to the verb (van Koppen, 2006), so the closest conjunct is an accessible agreement controller. For preverbal subjects, full agreement is required. This is either because the subject and the verb are in a Spec-head relationship (Munn, 1999) or because the subject linearly precedes the verb (Marušič et al., 2007).

Word order effects are evident in languages without the option of closest conjunct agreement (e.g. English) and with non-conjoined subjects (Guasti & Rizzi, 2002), and the combined effects of linear proximity and word order relative to the verb provide evidence for a

two-stage model of agreement production, similar to that advocated by Franck et al (2006), but with an additional specification that agreement verification occurs at PF.

Future Directions

This study aims at extending language production research beyond canonical subjects in canonical positions to draw a more detailed picture of how the grammar interacts with the language production mechanisms, and specifically how issues of meaning, linear word order, and adjacency factor into the production of agreement. Of course, this is just the beginning. More work needs to be done on the structural and linear relationships in language, particularly by looking at agreement in head-final languages, in which accounts based on structural and linear relationships would make different predictions. Eye-tracking research is needed as well, as it can provide insight into the pattern of lexical access as well as to the speaker's referent at the time of speech production. Additional work also needs to be done to understand the numerosity of complex events, how they are construed, and how they coalesce to become notionally singular, as most measures of numerosity are built around objects, not events or activities. ERP or eye-tracking studies could uncover whether the lack of agreement is processed as a grammaticality violation, with and without local coherence, and also whether postverbal subjects create lesser violations than preverbal subjects, testing the verification analysis of Franck et al. (2006). And finally, work needs to be done to understand how issues of incrementality and the requirements of online production can coincide with accounts such as Franck et al. (2006), to determine how both linear and hierarchical structures are built, how agreement targets locate their values, and how all of this works together to produce agreement.

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APPENDIX A: MATERIALS FOR SENTENCE COMPLETION TASK

Simple Count	Simple Mass
the syndrome and symptom	the rain and wind
the hardcopy and disk	the cheese and milk
the page and script	the loyalty and honor
the item and story	the software and hardware
the city and zipcode	the prose and poetry
the cup and bowl	the mud and dirt
the summary and program	the power and success
the lid and can	the copper and iron
the viola and violin	the weight and size
the middle and tip	the beauty and emotion
the storyline and title	the dust and mold
the corporation and job	the tea and coffee
the name and address	the bread and water
the start and end	the principal and interest
the front and back	the silence and solitude
the username and password	the food and agriculture
Deverbal Count	Deverbal Mass
the reversal and retraction	the corruption and extortion
the substitution and disruption	the equipment and machinery
the reference and tutorial	the insulation and padding
the authorization and examination	the collaboration and cooperation

the rejection and disqualification	the rehabilitation and assistance
the resignation and ruling	the painting and remodeling
the interruption and intrusion	the licensing and education
the etching and carving	the bicycling and running
the scolding and citation	the involvement and leadership
the greeting and recognition	the opposition and fighting
the conflict and de-escalation	the exaggeration and lying
the deception and hijacking	the commercialization and globalization
the wedding and celebration	the preparation and cooking
the operation and recovery	the desperation and unhappiness
the discussion and settlement	the shipping and handling
the misunderstanding and reconciliation	the assessment and management
Collectives	Collectives, continued...
the album and soundtrack	the arsenal and battlefield
the exhibit and gallery	the collage and scrapbook
the university and library	the galaxy and constellation
the garden and orchard	the neighborhood and precinct
the appendix and glossary	the encyclopedia and thesaurus
the prison and jail	the bookstore and café
the playground and arcade	the harbor and marina
the catalog and directory	the church and museum

APPENDIX B: MATERIALS FOR PICTURE DESCRIPTION TASK

Animacy Contrast, Experiments 3-5				
Gender	human	animals	count nouns	mass nouns
Masc-Masc	policeman and fireman soldier and sailor	tiger and elephant grasshopper and bear	bench and ladder house and mailbox	rain and lightning gas and wood
Masc-Fem	doctor and nurse king and queen	wolf and owl horse and cow	bed and pillow door and paintbrush	bread and cheese popcorn and butter
Fem-Masc	woman and man girl and boy	cat and dog snake and rabbit	table and chair hammer and nail	soap and water coffee and tea
Fem-Fem	bride and nun cook and maid	bee and ant giraffe and mouse	fork and spoon towel and iron	music and perfume corn and soup

Noun Number Contrast, Experiments 3-5		
3 versions of each item: Singular-Singular, Singular-Plural, and Plural-Singular		
	animals	count nouns
Masc-Masc	eagle and bat zebra and peacock fox and monkey turkey and rooster	shirt and button envelope and teapot coat and zipper belt and comb
Masc-Fem	whale and seal fly and lion	boat and submarine purse and lock
Fem-Masc	frog and penguin worm and scorpion	star and moon rose and balloon
Fem-Fem	duck and swan turtle and chicken snail and ostrich mosquito and butterfly	backpack and camera kite and umbrella pot and candle tree and whistle

CURRICULUM VITAE

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Department of Linguistics

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EDUCATION

University of Illinois at Urbana-Champaign, Urbana, IL

Ph.D. in Linguistics, October 2007

Thesis Title: "Conjunctions and Grammatical Agreement"

Thesis Advisor: Dr. Kathryn Bock

Committee Chair: Dr. Elabbas Benmamoun

Committee Members: Dr. Richard Sproat and Dr. Peter Laserson

M.A. in Linguistics, Summa Cum Laude, December 2002

Truman State University, Kirksville, MO

B.A. in Russian, General Honors, Magna Cum Laude, May 2001

RESEARCH INTERESTS

Psycholinguistics; Syntax; Arabic Linguistics

PUBLICATIONS

Lorimor, Heidi, J. Kathryn Bock, E. Zalkind, A. Sheyman, and R. Beard. "Number Agreement and Attraction in Russian." Manuscript submitted for publication.

Benmamoun, Elabbas and Heidi Lorimor. 2006. "Featureless Expressions: When Morphological Markers are Absent." *Linguistic Inquiry* 37, 1-23.

Lorimor, Heidi. 2005. "Agreement Alternations: How Optional Patterns of Agreement Arise." *Perspectives In Arabic Linguistics XVII-XVIII*. Elabbas Benmamoun and Mohammad T. Alhawary, eds. Amsterdam: John Benjamins. 222-239.

PRESENTATIONS

"Word Order and Agreement Asymmetries in Lebanese Arabic and English". Paper presented at the 31st Penn Linguistics Colloquium. February 23-25, 2007. Philadelphia, PA.

“Variable Agreement with Conjoined Subjects.” Paper presented at the Linguistics Departmental Seminar. October 19, 2006. University of Illinois at Urbana-Champaign.

“The Effects of Word Order and Noun Type on Agreement with Conjoined Subjects.” Poster presented at the 3rd International Workshop on Language Production. August 13-15, 2006. Chicago, IL. (With Erica Middleton and Kathryn Bock)

“One and One Makes Singular Agreement.” Poster presented at the 19th Annual CUNY Conference on Human Sentence Processing. March 23-25, 2006. New York, NY. (With Erica Middleton and Kathryn Bock)

“Number Agreement and Attraction in Russian.” Paper presented at the Annual Meeting of the Linguistic Society of America, January 5-8, 2006. Albuquerque, NM. (With Kathryn Bock)

“A Case for Notional Agreement: Number Agreement and Attraction in Russian.” Paper presented at the Linguistics Departmental Seminar, November 11, 2004. University of Illinois, Urbana-Champaign.

“Syntactic Expressions of Semantic Agreement Effects.” Paper presented at the Arabic Linguistics Symposium. March 19, 2004. University of Oklahoma, Norman, OK.

“Language Choice for African Literature.” Paper presented at the Africa-in-Academics Student Association Conference. March 1, 2003. University of Illinois, Urbana-Champaign.

INVITED PRESENTATIONS

“Producing Subject-Verb Agreement with Conjoined Subject Noun Phrases.” Paper presented at the Beckman Institute Graduate Seminar. May 10, 2006. University of Illinois, Urbana-Champaign.

TEACHING EXPERIENCE

Guest Lecturer for Graduate Seminar on Corpus Methods and Modeling for Phonetics and Phonology (LING 591) University of Illinois, Fall 2006.

- Taught on “Investigating Durational Correlates to Subject-Verb (*dis*)Agreement”

Lecturer for Elements of Psycholinguistics (LING 225) University of Illinois, Spring 2004, Spring 2005-Fall 2006.

- Delivered bi-weekly lectures
- Managed course of 70-90 students
- Developed syllabus and course website
- Wrote exams and homework assignments
- Supervised honors projects
- Coordinated course content with discussion section leaders

Guest Lecturer for Introduction to Syntax (LING 301) University of Illinois, Spring 2006.

- Taught on the acquisition of syntax

Guest Lecturer for Introduction to Language Science (LING 100) University of Illinois, Spring 2005, 2006.

- Taught on “Language and the Brain”

Instructor for Elements of Psycholinguistics (LING 225) University of Illinois, Summer 2003.

- Full course responsibilities

Violin and Viola Instructor Conservatory of Central Illinois, Champaign, IL, 2001-2005.

- Taught children ages 6-16 in the Suzuki-Rolland program
- Met weekly with studio of 12 private students to supervise progress and refine technique
- Led weekly group lessons to encourage review and ensemble skills
- Coached chamber music ensembles in competitions

Writing Consultant The Writing Center at Truman State University, 2000-2001.

- Coached students through all stages of the writing process
- Developed and maintained database to track Writing Center usage and student feedback

RESEARCH EXPERIENCE

Project Coordinator for agreement studies in English, Hindi, and Arabic. The Language Production Lab at the Beckman Institute for Advanced Science and Technology. UIUC, 2005-present.

- Obtained research grant to pay subjects and research assistants
- Designed test materials
- Recruited and trained Arabic- and Hindi-speaking collaborators to help with design, transcription, and coding
- Supervised undergraduate research assistants in running experiments, transcriptions, and coding data
- Met with undergraduates biweekly to discuss relevant research articles
- Developed independent study for advanced undergraduate students, allowing them to participate in and receive credit from the research project
- Worked with Institutional Review Board to gain research approval

Project Coordinator for Russian agreement experiments. The Language Production Lab at the Beckman Institute of Advanced Science and Technology, UIUC, 2003-2004.

- Compiled research from previous studies
- Recruited native Russian speakers to participate in the study
- Conducted experiments and analyzed data
- Managed payment of participants and other native Russian speakers who were helping with experimental materials

STUDENT SUPERVISION

Co-Supervised Zak Hulstrom's Advanced Research Project (Psych 494) with Archana Bhatia, "Linear order and directional branching: Do head-final languages show the same linear word order effects as head-initial languages?" University of Illinois at Urbana-Champaign, Spring 2007.

- Developed reading list
- Trained student on material development and worked together to finalize experimental design
- Supervising student in running experiments, transcription, coding
- Project culminated in research paper

Supervised Jason Kahn's Advanced Research Project (Psych 494), "Verbal nominals as agreement controllers". University of Illinois at Urbana-Champaign, Fall 2006.

- Worked together to select research question, develop testable hypotheses, and devise experimental materials
- Project culminated in research paper

Supervised Undergraduate Research Assistants. The Language Production Lab at the Beckman Institute of Advanced Science and Technology, UIUC, 2005-present.

- Recruited and interviewed potential research assistants
- Trained and supervised assistants in subject running, transcriptions, coding, norm collections, and basic data analysis
- Held biweekly meetings to discuss articles relevant to research

UNIVERSITY SERVICE

Assisted with NELS37, the 37th annual meeting of the North East Linguistics Society at the University of Illinois at Urbana-Champaign.

Conducted series of workshops on research methodology, statistics, and experimental design, 2005-2006.

- Selected background reading material and organized workshop sessions
- Presented basic concepts in research methods and design
- Worked with graduate students attending the sessions on applying the methodological concepts to their own research

Developed and implemented New Student Orientation for linguistics graduate students, 2004-2006.

- Compiled pre-arrival informational materials
- Organized opportunities for new students to meet continuing students and faculty
- Planned orientation, involving faculty presentations about programs and requirements

Assisted in organizing the 19th Arabic Linguistics Symposium, April 2005.

- Coordinated volunteers, packet materials, and book table

Served on Expanded Arts and Humanities Committee of the Fellowship Board for university-wide Block Grant Competition. October 2004.

- Evaluated proposals from Arts and Humanities campus units to determine allocation of fellowship monies

GRANTS, FELLOWSHIPS, AND AWARDS

Recipient of the 2007 C.C. Cheng Award for Graduate Student Research. Presented by the Department of Linguistics, UIUC.

Departmental Fellowship. The Department of Linguistics, UIUC, Summer 2006.

Recipient of the 2005 Silver Jubilee Teaching Award to the Outstanding Teaching Assistant. Presented by the Department of Linguistics, UIUC

Included in the “Incomplete List of Instructors Ranked as Excellent by Their Students”, Fall 2005, Spring 2006, Fall 2006.

Research Board Grant. UIUC, “Subject-Verb Agreement in Arabic and English”, 2006. (PI: Elabbas Benmamoun)

Beckman Institute for Advanced Science and Technology Graduate Fellowship, UIUC. “Conjunctions and Grammatical Agreement: When wholes differ from the sums of their parts”, 2005-2006.

Foreign Language Area Studies Fellowship. Through the Global Studies Center, UIUC. For the study of Modern Standard Arabic, 2004-2005.

Cognitive Science / AI Fellowship. The Beckman Institute for Advanced Science and Technology, UIUC. “Counting Conjunctions; a corpus study of agreement with conjoined subjects”, Summer 2004.

Departmental Fellowship. The Department of Linguistics, UIUC, Fall 2003.

Foreign Language Area Studies Fellowship. Through the African Studies Center, UIUC. For the study of Modern Standard Arabic, 2002-2003.

Illinois Humanities Fellowship. 2001-2002.

Outstanding Student in Russian. Truman State University, Kirksville, MO, 2001. Awarded maximally to one graduating senior each year.

Pershing Scholar. Truman State University, Kirksville, MO, 1997-2001. Involved full scholarship (tuition and room and board) as well as a stipend to study abroad.

REVIEWS

Occasional reviewer for journal: *Cognitive Linguistics*.
Refereed abstracts for *Arabic Linguistics Symposium, 19*.

LANGUAGES

Native: English
Fluent: Russian
Proficient: French
Intermediate knowledge of Modern Standard Arabic, spoken and written
Elementary knowledge of Zulu

TECHNICAL SKILLS

Proficient in designing course websites using software such as WebCT.
Proficient in using experimental design software such as PsyScope.
Some experience in awk, linux, html, and python programming.
Familiar with SAS, Superanova, and R statistical packages.

PROFESSIONAL MEMBERSHIPS

LSA (Linguistic Society of America)
Phi Beta Kappa
Phi Kappa Phi